CHARLES UNIVERSITY IN PRAGUE

FAKULTY OF SOCIAL SCIENCE

Institute of Economic Studies

Diploma thesis

2011 **Veronika Mašková**

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Inflation Targeting in Emerging Market Economies

Diploma thesis

Prague 2011

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Academic year: **2010/2011**

Bibliographic Evidence Card

MAŠKOVÁ, Veronika: *Inflation targeting in Emerging Market Economies*, Prague, 2011. 87 pages. Diploma thesis, Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies.
Supervisor: Doc. Mgr. Tomáš Holub Ph.D.

Abstract

The main objective of the thesis is to analyse the suitability of inflation targeting, a monetary policy regime which focuses on the achievement of the price stability, for the emerging market economies. The performance of inflation targeting countries is compared to the performance of non-inflation targeting countries which use other monetary policies such as the monetary aggregate target or exchange rate anchor. Regressions, using the difference-in-differences estimation approach, are run to assess the contribution of the inflation targeting framework to the development of economic variables such as the CPI, GDP, national interest rate etc. Economic outcomes of the financial crisis period (2007-2010) are crucial part of the thesis. The convenience of the inflation targeting framework for the emerging market economies is derived. This holds also for the severe situations such as the crisis since it lowers the volatility of the main variables of the interest.

Keywords: inflation targeting, monetary economics, monetary policy, emerging market economies, difference in differences estimation, financial crisis

Abstrakt

Hlavním cílem diplomové práce je analýza vhodnosti použití inflačního cílování, tedy režimu měnové politiky zaměřujícího se na dosažení cenové stability, v zemích rozvojových ekonomik. Výsledky dosažené zeměmi, které jako svou měnovou politiku využívají inflační cílování jsou zde srovnány s výsledky dosaženými zeměmi, které používají jiné druhy měnové politiky. Těmi jsou například cílování peněžní zásoby nebo cílování měnového kurzu. Efekt inflačního cílování na vývoj ekonomických ukazatelů rozvojových ekonomik je měřen za použití metody diference v diferencích. Jde zejména o proměnné postihující vývoj inflace, HDP, úrokové sazby apod. Důležitou součástí práce jsou ekonomické výsledky dosažené během období krize (2007-2010). Z diplomové práce vyplývá vhodnost zavedení inflačního cílování v rozvojových zemích a to také pro období krize, protože vede ke snížení variability hlavních ekonomických ukazatelů.

Klíčová slova: inflační cílovaní, monetární ekonomie, měnová politika, rozvojové ekonomiky, odhad diference v diferencích, finanční krize

Prohlášení

Prohlašuji, že jsem předkládanou práci zpracoval/a samostatně a použil/a jen uvedené prameny a literaturu.
Souhlasím s tím, aby práce byla zpřístupněna pro studijní a výzkumné účely.

Declaration

Hereby I declare that I compiled this diploma thesis independently, using only the listed literature and resources.
I agree with disclosure of the thesis for the educational and research purposes.

Prague, 18th May 2011

Veronika Mašková

Acknowledgments

I would like to express my gratitude to Doc. Mgr. Tomáš Holub Ph.D. from IES FSV UK and ČNB for supervising my thesis and for continuous encouragement.

Master Thesis Proposal

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Proposed Topic:

Inflation targeting in emerging market economies

Topic Characteristics:

Inflation targeting is one of the monetary policy frameworks used by the central bank to maintain the price stability in the economy. The final goal of the price stability is under this framework achieved by setting the particular level of inflation or boundary of levels that should not be crossed. The actual inflation is then maintained to move towards the targeted one through interest rate changes and other monetary policy tools. The inflation targeting is assumed to be successful framework to maintain the price stability. Numerous central banks over the world follow this policy. Recent data shows the evidence of IT outcomes mainly for the industrial and developed countries. The framework has been increasingly discussed for the case of emerging market economies as well, but the analysis for this group of countries is still more limited. The work should therefore focus on the evolution and performance of the inflation targeting in emerging market economies. The assessment of the framework for the purposes of price and economic stability during the current financial and economic crisis should be also derived, which is so far lacking in the economic literature. IT is compared with other possible monetary frameworks because the overreliance on the IT has been questioned during the crisis.

The topic is relevant because of the afterglow of the economic crisis. With the recovery of the economies and their public sector indebtedness, the era of higher inflation (compared to the pre-crisis state) may follow. Therefore the most suitable monetary policy framework should be known

Hypotheses:

1. Hypothesis #1: Implications of inflation targeting for the EMEs countries. Is this framework suitable for these economies or can only the developed countries profit from it?
2. Hypothesis #2: Particular benefits and costs of the IT implementation in EMEs. Should EMEs follow this framework or is there any explicitly better performing one?
3. Hypothesis #3: Performance of the inflation targeting during the economic crisis. Analysis of recent data explaining how the IT framework performed with respect to the crisis environment. Has it performed better than alternative policy regimes?

Methodology:

Empirical analysis of the performance of the IT countries before and during the current financial and economic crisis. The focus will be put on: the level and variability of inflation; fulfilment of inflation targets; the pace and variability of the GDP growth; evolution of the output gap; and possibly other indicators of the internal and external balance of the economy such as the credit growth, current account balance etc. Data from official sources will be used (IMF IFS; OECD; national central banks and statistical offices etc.).

Outline:

- Origin of the inflation targeting (when, were and how did it emerge).
- IT outcome history (developed countries v. emerging market economies).
- Performance of the IT
- Criteria for the framework implementation
- Analysis of present data, actual indicators and their values assessment
- Characteristic and analysis of costs and benefits of the IT implementation in EMEs
- IT in EMEs in the economic crisis environment

Core Bibliography:

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Supervisor

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1. Introduction

Inflation targeting is one of the possible monetary policy frameworks used by the central banks to maintain the price stability as their primary monetary policy goal. The price stability is in this case maintained by setting the particular level of inflation or specific boundary levels that the central bank aims to achieve. The actual inflation is then maintained to move towards the set target through the changes in the monetary policy instruments, most frequently interest rates. The empirical evidence suggests the inflation targeting to be a successful framework to maintain the price stability and numerous central banks over the world follow this flexible policy rule. Recent data and outcomes of related literature show the evidence of inflation targeting mainly for the industrial and developed countries, which implemented this framework among the first. The inflation targeting has been increasingly discussed for the case of emerging market economies as well, but the analysis for this group of countries is still more limited. This holds especially for the time period of the recent global financial crisis.

The aim of this work is therefore to evaluate the inflation targeting in relation to the emerging market economies. While the use of this policy was successful over the time among the developed countries, it should be explored if this is the right possibility for the emerging market economies. The assessment of the framework should be derived for the purposes of the price and economic stability during the financial and economic crisis and its afterglow. This is topic so far lacking in the economic literature of the emerging market economies. While the overreliance on the inflation targeting has been questioned during the crisis, it should be also compared with other possible monetary frameworks.

The assessment of these issues is relevant nowadays because the economies are at the end or even in the afterglow of the economic crisis. With the recovery of the economies and their related public sector indebtedness, the era of higher inflation, compared with the pre-crisis state, may follow. Therefore the most suitable framework for maintaining the price stability should be known and used especially by the emerging market economies (EMEs) which affect the global economy in increasing manner. EMEs are the most vulnerable economies to the external shocks and they suffer from high volatility of main economic variables. These negative issues could be partly overcome by the inflation targeting implementation in the emerging market economies and this work aims to support this argument (IMF 2011).

The structure of the work is following. Chapter 2 is devoted to the operational framework of the inflation targeting and its characteristics. It also includes the discussion of the preconditions of the inflation targeting implementation and specifies selected emerging market economies. Chapter 3 discusses the financial crisis period (2007 – 2010) since the evaluation of behaviour of the economic variables under this framework is crucial part of the work. Chapter 4 includes subchapters dealing with development in specific economic variables such as the CPI, GDP, output gap or real effective exchange rate. Chapter 5 presents the main econometric method used here to compare the different monetary policy outcomes, the difference in differences. Using this approach the subchapters deliver regressions and results regarding the main economic indices. Chapter 6 extends the estimations for other economic indicators such as the national interest rate, balance of trade or unemployment rate. Following chapter 7 deals with future predictions of the implementation and existence of the inflation targeting regime and chapter 8 concludes the work with the summary of main findings.

Literature overview

To assess the outcomes of the inflation targeting and data for particular countries, relevant literature and specific country´s monetary authority information is used in this work. Other official sources of information, such as the IMF´s International Financial Statistics or OECD statistics, are used.

The basic structure of the inflation targeting is properly derived by Svensson. His contribution to the discussions and developments in the theoretical field of this monetary policy is of the main importance since his work is among the most quoted while touching the inflation targeting issue. Therefore are his findings the main source for the theoretical background of this work. Another important author in this field is Walsh. His research pioneered the inflation targeting and his theoretical findings on this framework are presented throughout the work. Since this work includes also descriptive parts where the relevant authors and their thoughts are quoted, broader literature overview is not necessary.

2. The inflation targeting framework

Focus on this monetary policy framework is crucial since it stands for an advanced tool for lowering the level of inflation as well as its maintenance on the low level. Hand in hand with this goes the ability to guide the inflation expectations of the economic agents (Svensson and Woodford 2004) without any negative impact in terms of the output volatility (Rogger and Stone 2005).

2.1. Operation of the inflation targeting

However, according to King, the inflation targeting is a professional decision making process and does not stand for the exact answer to crucial economic questions. Therefore the overreliance on the inflation targeting regime should not be present and its advantages should not be seen as a direct proof that the regime is the most suitable for every economy. In fact, King suggests that the regime of the explicit inflation target is just the implementation of an "optimal policy reaction function" (King 2004, 13). Svensson expands the discussion of the regime with the definition of reaching the desirable approach with the inflation forecasting mechanism (Svensson and Woodford 2004).

The monetary policy actions are performed by the instrument and targeting rules (Svensson). The instrument rule can be a function of the predetermined variables (than it is called an explicit instrument rule) or of the forward looking variables (implicit instrument rule) (L. E. Svensson 1998, a). The explicit rule might be of the form $i_t = fX_t$, which is a linear reaction function (f being n_i x n_1 matrix, response coefficients) and the implicit rule might be of the form $i_t = fX_t + gx_t$ (g ... matrix of appropriate dimension; f and g are prescribed). As the simple instrument rule, the Taylor rule is derived in following form:

$$i_t = \bar{\imath} + 1.5\,(\pi_t - 2) + 0.5y_t$$[1]

The Taylor rule is than an explicit instrument rule in the case of predetermined π_t and y_t at *t* and an implicit instrument rule in the case of the forward-looking variables at *t*. Inflation targeting may be also called "a targeting rule with a relatively explicit loss function to be minimized" (L. E. Svensson 1998, 13, a). The loss function can be generally interpreted in the following way

[1] "i_t ... federal funds rate in quarter t, $\bar{\imath}$ ... average federal funds rate(4%), π_t ... 4-quarter inflation, y_t ...output gap, federal funds rate responds to deviations of inflation from 2% level and to the output gap with coefficients 1.5 and 0.5" (L. E. Svensson, Inflation Targeting as a Monetary Policy Rule 1998, 6).

$$L_t = \frac{1}{2}[(\pi_t - \hat{\pi})^2 + \lambda y_t^2]\ ^2.$$

The relative weights on output gap stabilization λ further implies whether the regime represents strict inflation targeting, λ=0, or the flexible one, λ>0. Svensson, together with other authors, uses the flexible approach for their simulations, since "in practice, inflation targeting is never "strict" but always "flexible" (L. E. Svensson 2010, 1).

The money targeting based monetary policy might be criticised for its overreliance on the money demand behaviour, the inability of central banks to predict it precisely. On the other hand, similar issue might occur under the inflation targeting since the authority, the central bank, does not have perfect control over the inflation. The limited ability to control the inflation is reinforced by the "lags in the transmission mechanism" (L. E. Svensson 1998, 15, a) as already described above and the uncertainty about the process of the transmission including possible shocks faced by the economy. This partially explains why it is difficult to access the outcome of the regime. The time which elapses between the policy setting and its effect on the economy is crucial while other issues might enter the process during the period. To overcome these disadvantages, the inflation targeting is incomplete without the forecasting of the future stance of the economy and the crucial variables involved. Therefore is the "inflation-forecast targeting" used as an explicit rule of the inflation targeting regime (L. E. Svensson 1998, a). The central bank manages the interest rate of its monetary policy to maintain the inflation forecast accordingly to the inflation target it has set before (de Mello 2008, 109). Together with the target, the forecasting model and reports on inflation (means of the communication of the policy to the public which enhance the transparency of its actions), is the inflation forecast targeting the most important part of the inflation targeting approach (de Mello 2008). Crucial part of the forecast targeting are then so called escape clauses which should explain why the target have not been met for example since the economy faced unexpected shocks and therefore the transparency and accountability of the central bank should not be harmed (Fuhrer, et.al. 2009). It does not matter if the authority implementing inflation targeting regime uses modified Phillips curve or the forward looking Taylor rule for the forecasting of the inflation. The general consensus remains that the model cannot be used alone and that more information outside the model have to be included to the research to conduct "modern and practical monetary policy" (L. E. Svensson 1998, 18, a).

[2] π_t ... inflation in period t, $\hat{\pi}$ ... inflation target (or in some cases may stand for the midpoint of the target band), y_t ...output gap, $\lambda \geq 0$ ... relative weights on stabilizing the output gap (L. E. Svensson 1998, 14, a).

Those are only few issues to demonstrate the importance of the use of the open economy inflation targeting approach. The emerging market economies this work deals with are the case of open economies and therefore the distribution of the shocks and other economic disturbances brought by this channel need to be also considered. Regarding the development of the international trade and the approach of the economies worldwide which integrates higher openness of the markets, the exchange rate should be included in the discussion. This helps to simulate the economy behaviour in more adequate way since it adds another transmission channel. As for example Svensson states the appearance of the exchange rate shows its influence on the" foreign and domestic demand for domestic goods" (L. E. Svensson 1998, 3, b) and therefore influences the aggregate demand channel. This implies for the effects of the real exchange rate[3]. For the purposes of the inflation measures, the consumer price index (CPI) is generally used and therefore the exchange rate changes might influence the inflation directly through the changes it does to the prices of imported goods which enter the CPI basket. As all the transmission mechanisms involve lags, the importance of the exchange rate here is that the lag associated with its direct influence on the CPI is supposed to be smaller than the one generated in the aggregate demand channel (L. E. Svensson 2010).

2.2. Characteristics of the inflation targeting

As the evidence says, the inflation targeting enhanced the macroeconomic performance of emerging market economies. It also proved that one of its essential features, "commitment to an explicit target", enables it to overcome the "demand shocks and financial crises" (Walsh 2009, 1, a). Using this specific target, the central bank is able to measure its performance by comparing the achieved level of inflation to the announced target (L. E. Svensson 1996). This kind of measurement is also applicable for the inflation expectations and in general, this provides the central bank with the assessment of its credibility. The monetary policy actions are therefore easy to evaluate and the central bank gains accountability. That creates a commitment process which can reduce potential inflation bias and help to achieve the desired level of inflation as well as inflation expectations (L.

[3] Using the aggregate demand channel, the monetary policy is transmitted through the effect on the aggregate demand caused by changes in the short real interest rate. The inflation rate is than affected by the aggregate demand through the aggregate supply equation, the Phillips curve. Third crucial channel is the expectations channel through which are the inflation expectations of the economic agents influenced by the use of "wage and price setting" (L. E. Svensson, Open-Economy Inflation Targeting 1998, 3). All these actions include different time lags.

E. Svensson 1996). The inflation targeting system stands on pillars that at the same time create the whole framework and are further reinforced by its actions.

2.2.1. The full-fledged targeting

According to Stone (2005), it is possible to divide the monetary policies that use some inflation target into three main types due to the differences in credibility in commitment to the announced inflation target. These are: "full-fledged inflation targeting, implicit price stability anchor" and "inflation targeting lite" (Carare and Stone 2005, 1297). For the purposes of this work, the full-fledged inflation targeting is most important. This is the type of inflation targeting with the highest level of credibility[4] and commitment to the inflation target. It is a transparent monetary rule which promotes the central bank´s credibility to the announced target (Carare and Stone 2005). The full-fledged inflation targeting contains the basic stylized facts that can help to guard the emerging market economies to follow the industrial countries in inflation targeting framework implementation (Rogger and Stone 2005). Inflation targeting is highly linked to the need for transparency and accountability. These elements enable to the central bank to gain credibility and to enforce its incentives in meeting the stated target of inflation (Rogger and Stone 2005).

[4] "Credibility is proxied by the actual inflation outturn and by market ratings of long-term local currency government debt" (Carare a Stone 2005, 1298).

2.2.2. Challenges of the IT adoption

The inflation targeting comprises special challenges for the emerging market economies, these are the need to "build credibility; reduce the level of inflation, and to deal with fiscal, financial and external dominance" (Fraga, et.al. 2003, 14). Many problems are enhanced by the weakness of the institutions, including the central bank, and by the time needed to build the credibility, since there are no records of the past actions the authority have done aiming for the inflation reduction or stabilization. The EMEs adopted the inflation targeting with relatively high levels of inflation. As Fraga et al suggest in their study from 2003, this was on average 13.1%. The countries used for the purposes of this work show average inflation rate at the time of adoption of 6.6%. The difference between the two results is caused by different sample of emerging market economies adopting IT used in each case. This work uses sample of 19 IT countries. Only in situations where data for particular country and period are not available, the country is omitted from the sample. Fraga et al used sample of 12 countries and their average year of IT adoption was 1997 while this works´ countries have adopted the IT on the average in 2002. Therefore the average inflation at the time of the IT regime adoption differs. This work reflects countries that newly implemented the regime and also the fact that some of the countries, e.g. the Czech Republic or Israel as included by Fraga et al, are not listed as emerging economies anymore. Some authors argue that the level of 10% of CPI should stand for a threshold for the framework adoption but the practise shows that the presence of declining trend is more important (Rogger and Stone 2005).

Higher levels of the inflation explain why the disinflationary targets were set at the beginning rather than the usual inflation targets known e.g. from advanced economies performing the IT. The disinflationary targets are short term targets and the authority tends to reach the desired low level of the inflation to be set as a future target for some longer horizon. Along with the inflation lowering emerges a possible threat of output volatility which would enhance the costs of inflation reduction. Therefore a trade-off between followed economic variables maintenance needs to be done to balance the costs and profits coming from lower inflation (Fraga, et.al. 2003).

The reduction in the inflation rate follows large target misses. Although the banks´ commitment to particular target would seem to require very strict following of it by every means, the opposite is actually true. The experience of the IT countries report numerous misses of the targets under the flexible inflation targeting. Countries maintaining stable

inflation miss the target with probability of 1/3 and those with disinflation policies with the probability of 2/3 (Rogger and Stone 2005).

2.2.3. Preconditions of the IT implementation

The central bank as a monetary authority of inflation targeting country needs to posses following essential issues of this framework to be able to meet the inflation target (Rogger and Stone 2005, 6).

First issue covers the main goal of this monetary policy. That is a price stability delivered by the low inflation and only for this goal a specific numerical target is stated (International Monetary Fund 2006). Level of inflation is in the medium term the issue this monetary policy can focus on. The explicit quantitative target of inflation is usually in the form of a point or an interval varying from 1.5 to 2.5 percent per year (L. E. Svensson 1998, b). The central bank´s responsibility is than to commit that it will maintain the rate of inflation to this explicit target (Apergis, et.al. 2005). In the same time, no specific intermediate targets of the monetary policy, for example exchange rate target or money growth target, are set under inflation targeting (L. E. Svensson 1996).

Next crucial issue that characterises the inflation targeting is an operating procedure of the monetary policy called inflation forecast targeting (L. E. Svensson 1998, b). This is also the optimal intermediate targeting rule for the inflation targeting and stands for a mean ensuring that the first order conditions for the minimum of the loss function are fulfilled (L. E. Svensson 1998, b). According to the broadly accepted view that the emerging market economies possess low credibility of the monetary authority and generally fragile institutions as well as the macroeconomic instability (Fraga, et.al. 2003), set of preconditions for the inflation targeting implementation is questioned. The four main preconditions are listed in the table 1 below.

Table 1: IT implementation preconditions

Preconditions	Institutional independence
	A well-developed technical infrastructure
	Economic structure
	A healthy financial system

Source: (Batini, et.al. 2005, 175)

The institutional independence reassures the central bank that it can choose at least its instruments independently on the government or other authority. Under the IT regime, central bank´s mandate should clearly introduce the explicit target for inflation and state

specifically that the price stability is the primary aim of bank´s actions and introduce it to the public (Truman 2003). Central bank should possess the legal autonomy to be able to resist the attempts of the politicians to use it for monetizing government deficits and impose other pressures on the central bank (Batini, et.al. 2005). Its independence and clear mandate should be accompanied with the "strong fiscal position" (Bernanke and Woodford 2005, 357) of the economy. This requirement was not met by all adopters, for example the Czech and Hungary case suggests that the fiscal deficit had been significant. As Bernanke, claims, this did not have significantly negative consequences, since the fiscal deficit was a part of the transition of the economies and was not cured by the monetary means which would enhance the fiscal dominance of the monetary policy (Bernanke and Woodford 2005, 357). The fiscal dominance is one of the problems that leads to undesirable outcomes of the monetary policy and is in conflict with the inflation targeting. The government unable to finance its market actions requires seigniorage and other means of financing from the central bank, to be able to cover its expenditures. This makes the central bank weak and lowers its ability to achieve the set inflation target. While the fiscal situation is under control, the inflation targeting can contribute to the macroeconomic stability (Truman 2003).

Another precondition is according to Batini a "well-developed technical infrastructure" (Batini, et.al. 2005, 175). This issue is derived from the fact, that the advantages of the inflation targeting regime are developed through its ability to predict future inflation and "anchor expectations of future inflation" (Walsh 2009, 14, a). The state of the future inflation is crucial for the inflation targeting while the transmission mechanism through which the central bank manages the goal of price stability does not have immediate effect on the economy. There are time lags, e.g. in the Czech case it is around 1.5 year, for the interest rate changes made by the central bank to be translated to the inflation behaviour. Therefore for its decision making the central banks need the information about future inflation rather than its present state (Holman 2008). The central bank needs good inflation forecasting and modelling ability however, the evidence says that the inflation targeters begun with very simple tools or some of them with no ability of forecasting and without any model (Batini, et.al. 2005). In hand with this issue goes the availability of the data on inflation, which differs among the emerging market economies (Batini, et.al. 2005). Many central banks proved that they do not need perfect tools for predictions at the beginning but are able to find the right tools over time. They act according to its experience and with the

help of surveys on the current inflation try to forecast and then learn from possible mistakes and adjust the tools in the most desirable way (Truman 2003, 55). Process of finding the right level and direction of suitable policy instruments requires greater effort among the emerging market economies than among the industrial countries. The emerging market economies are more often facing the shocks coming for example from the deregulation of prices, significant level of economy openness and overall effort to follow the advanced economies. Due to the possible long period of high inflation is the current inflation (at the time of IT adoption) unstable in the emerging market economies (Bernanke and Woodford 2005, 358). As an example of not using the most difficult models while the economy is not yet prepared, Bernanke uses the case of the Czech National Bank which in the 1999 "introduced a survey of inflation forecasts by market participants to measure inflation expectations" (Bernanke and Woodford 2005, 358).

The "well-developed technical infrastructure" is directly linked to the last two preconditions stated in the table 1, "economic structure" and "a healthy financial system". In fact, all the preconditions mingle significantly. As Batini et al suggest with the help of their research, with the deregulated prices, low reactivity to prices of commodities and movements of the exchange rate as well as state of measures of "risk-weighted capital adequacy ratio" or "financial market depth" [5] (Batini, et.al. 2005, 177), should be the economy prepared to smoothly adopt the inflation targeting framework. For example the possibly frail banking system would cause the emergence of the requirements from the financial institutions on the liquidity provided to them by the central bank. Increase in the interest rate (done by the central bank) can be destructive for those weak institutions. Without the cooperation of the financial system, the central bank is trapped in inability to meet the target and thus lowers its credibility. Critics use this precondition to show that the central banks focusing on inflation can possibly divert the attention from checking the financial system stability (Truman 2003).

Many authors of the related literature agree up on the fact that it is not necessary for the adopters to fulfil the preconditions fully but only to the certain degree to be able to implement inflation targeting and possibly profit from it. For example Truman argues that the difference between the emerging and industrial economies is exaggerated in terms that the emerging markets must meet the preconditions to proceed further with the inflation

[5] "ratio of stock market capitalization to GDP, ratio of private bond issuance to GDP, stock market turnover, and the maximum maturity of actively traded nominal bonds"

targeting. This is in line with Batini et al survey which shows that no country (applying for both industrial and emerging market economies) met all the preconditions before it adopted the framework. The lack of fulfilment of the requirements is not restraining the emerging market economies. The Batini et al work presents informal econometric tests which show that "no precondition enters significantly in the equations explaining the improvement in macroeconomic performance after inflation targeting adoption" (Batini, et.al. 2005, 178).[6]

2.3. Origin of the inflation targeting, the New Zealand case

Inflation targeting appeared in the monetary policy systems in late 1980s in industrial countries such as New Zealand, Canada, the United Kingdom and Sweden (listed according to the date of adoption of this monetary policy regime) (International Monetary Fund 2006). The Reserve Bank of New Zealand, which is supposed to be a pioneer in integrating inflation targeting to the monetary policy (Rogger and Stone 2005), dates the implementation of the inflation targeting to the 1989. At that time the parliament released the Reserve Bank Act which had widened powers and competences of the bank. The competence of great importance is the use of independent monetary policy for dealing with inflation. Before the act, the bank promoted the general price stability as one of the goals of the monetary policy as well as for example the economical growth and level of employment. The focus on inflation had been underlined by the "Policy Target Agreement" approved by the Minister of Finance and by the Governor of the Reserve Bank (Reserve Bank of New Zealand 2009). This confirmation is in line with the important factor of the inflation targeting, the transparency which enforced the efficient delegation of the monetary policy, as for example stated in Svensson (L. E. Svensson 1998, a).

The approach of this monetary policy is that the price stability has to be defined in "specific and public contract" (Reserve Bank of New Zealand). The move to this monetary policy took a long time. From the 1950s, the Reserve Bank battled for its powers with strong government regulations and fixed exchange rate that was accompanied with almost non-existing modern financial markets. Therefore the support of economic growth, employment and price stability was not easy since the appropriate tools for the bank were missing. According to the experience with high levels of inflation in 1960s and 1970s and ineffective government regulations, not only New Zealand but also other industrial

[6] The Batini et al survey outcome is summarized in the Annex 1: Preconditions and current conditions. It shows the robustness check of the baseline model they use in their work where 1 stands for the best current practice.

countries, found the possibility of reducing the inflation rate by the control of money supply. The Reserve Bank first took additional steps and introduced the specific target band for inflation (Reserve Bank of New Zealand 2007). This is nowadays one of the bench marks of inflation targeting as a monetary policy regime. Many central banks adopted inflation targeting framework to overcome bad experience with other monetary policies which uses as intermediate targets for example exchange rate peg (either soft peg or hard peg) or monetary aggregates (International Monetary Fund 2006). They tried as a monetary policy e.g. the monetary targeting, especially in years after the collapse of Bretton Woods system, 1970s and 1980s (Walsh 2009, a). But as Walsh (2009) refers, "none of these policy regimes proved either completely successful or sustainable." Regarding the inflation targeting, it is supported by the fact that while compared with the exchange rate regimes of monetary policy, the inflation targeting was not left by anyone who had adopted it previously (Walsh 2009, a).

According to Portugal (2007), 24 countries (8 industrial, developed countries and 16 developing and emerging market economies were using the inflation targeting as their policy framework in 2007 and still new central banks worldwide were considering this possibility. Nowadays, inflation targeting has been adopted by 29 countries (10 developed and 19 developing and emerging market economies) (IMF 2008).

2.4. Emerging market economies

With the help of IMF terms, the emerging markets could be specified as capital markets of some "developing countries that have liberalized their financial systems to promote capital flows with non-residents and are broadly accessible to foreign investors" (International Monetary Fund 2006, 17).

The table 2: Inflation targeting countries shows the selected inflation targeting emerging market economies used in this work. For the purposes of the comparison, the advanced IT economies are also included.

2.4.1. Division of monetary policy frameworks categories

To usefully select the countries for the research the division on advanced economies and emerging and developing economies is done here similarly to the methodology used by the International Monetary Fund statistics. Using the IMF data and assuming the move of the Slovak Republic and Estonia among the EMU countries the table in the Annex 2 Monetary policy regimes shows nowadays division of monetary policy regimes worldwide according

to the authority behaviour towards the exchange rate.[7] Table 2 lists countries using the inflation targeting framework nowadays. While excluding the advanced economies, the rest are the countries of the interest in this work.

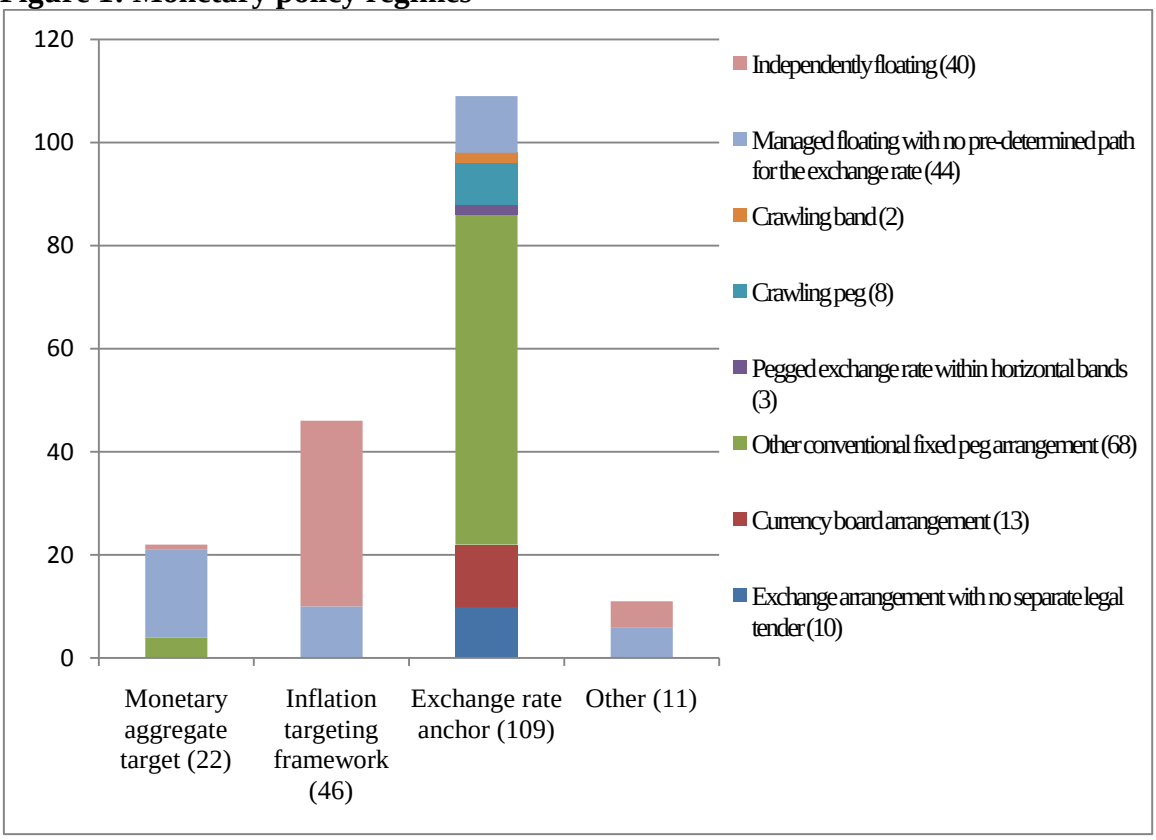
[7] The division of countries into the groups according to the level of their economic development is usefully depicted in (IMF 2008). For the purposes of this work, please see the Annex 3.

Table 2: Inflation targeting countries

Advanced Economies	IT adoption date	First target	Current inflation target	Current inflation (CPI) %	CPI at the time of IT adoption
United Kingdom	1992:Q3	1-4%	2%	4.7	3.7%
Canada	1991:Q1	3%-5%	2% (+-1%)	1.8	5.6%
Korea	2001:Q1	2.5% (+-1%)	3%(+-1%)	2.9	2.3%
Australia	1993:Q2	2-3%	2-3%	2.8	1.8%
Sweden	1993:Q1	2% (+-1%)	2%	1.1	4.7%
Czech Republic	1998:Q1	5.5-6.5%	2% (+-1%)	1.9	10.6%
Norway	2001:Q1	2,50%	2.50%	3.3	3.0%
Israel	1997:Q2	7-10%	1-3%	2.0	9.0%
New Zealand	1990:Q1	3%-5%	1-3%	1.5	6.1%
Iceland	2001:Q1	2.5% (-1.5%+3.5%)	2.50%	4.4	6.4%
Central and Eastern Europe					
Albania	2001:Q1	2-4%	3% (+-1%)	3.4	3.1%
Hungary	2001:Q3	7% (+-1%)	3%	3.8	10.5%
Poland	1999:Q1	<=9.5%	2.5%(+-1%)	2.2	7.3%
Romania	2005:Q3	7.5% (+-1%)	3%(+-1%)	7.5	9.0%
Serbia	2009:Q1	10% (+-2%)	6%(+-2%)	5.9	7.8%
Turkey	2006:Q1	5% (+-2%)	5.50%	8.4	10.5%
Armenia	2006:Q3	3% (+-1%)	4%(+-1,5%)	8.7	2.9%
Latin America and Caribbean					
Brazil	1999:Q2	8%(+-2%)	4.5%(+-2%)	4.6	4.9%
Chile	1999:Q3	15-20%	3%(+-1%)	2.1	3.3%
Colombia	1999:Q3	15%	3%(+-1%)	2.3	10.9%
Guatemala	2005:Q1	4-6%	5%(+-1%)	4.0	8.4%
Mexico	2001:Q1	<=13%	3%(+-1%)	3.7	6.4%
Peru	2002:Q1	15-20%	2%(+-1%)	2.2	0.2%
Uruguay	2000:Q1	?	4-6%	6.3	4.8%
Developing Asia					
Indonesia	2005:Q3	6%(+-1%)	5%(+-1%)	5.2	10.5%
Philippines	2002:Q1	5%-6%	4%(+-1%)	3.8	3.0%
Thailand	2000:Q2	0%-3.5%	0.5%-3%	3.3	1.6%
Sub-Saharan Africa					
Ghana	2002:Q1	22%	8.50%	9.4	14.8%
South Africa	2000:Q1	3%-6%	3%-6%	3.5	5.3%

Source: (IMF 2008) (IMF 2011), individual countries central banks

Figure 1: Monetary policy regimes



Source: (IMF 2008)

Figure 1 displays division of monetary policies which are used by individual countries worldwide. The second pillar, inflation targeting framework, includes countries performing independent floating or managed floating without determining the exchange rate path in advance. These are presented in table 3.

Table 3: Managed and independent floating countries

Managed floating with no predetermined path				
Armenia	Ghana	Indonesia	Romania	Thailand
Colombia	Guatemala	Peru	Serbia	Uruguay
Independently floating:				
Albania	Estonia	Italy	Poland	
Australia	Finland	Rep.of Korea	Portugal	
Austria	France	Luxembourg	Slovak Republic	
Belgium	Germany	Malta	Slovenia	
Brazil	Greece	Mexico	South Africa	
Canada	Hungary	Netherlands	Spain	
Chile	Iceland	New Zealand	Sweden	
Cyprus	Ireland	Norway	Turkey	
Czech Republic	Israel	Philippines	United Kingdom	

Source: (IMF 2008)

For further purposes, while using the group of independent floaters, the members of the European Economic and Monetary Union should be excluded, not only because the EMU as such is not an inflation targeter in the sense the targeters are specified in this work but also because the work deals with the emerging market economies.

The countries for the control group were chosen according to the level of development and regional similarities. Since the work uses mainly the data delivered by the IMF, the tools to derive these countries were also respecting the IMF division of countries. The Monetary policy regimes table (as depicted in Annex 2) and the Group of countries division according to the level of their development (Annex 3) were the bases. Only the category of Emerging and developing economies (as in the Annex 3) was used. Since the Annex 2 table shows the assignment of the monetary policy to each of the countries, only those emerging were used in three categories of monetary policy framework: inflation targeting, monetary aggregate targeting and exchange rate anchor. Few countries from other monetary policy framework were included to the estimations to enhance the sample of non-ITs. Those chosen countries were then grouped according to their regional characteristics. The groups are: Central and Eastern Europe, Developing Asia, Latin America and Caribbean and Sub-Saharan Africa (as in the Annex 3). The samples varies in the work since the data for the comparison group sometimes lack or are only of forecasted values, therefore are omitted in certain measurements. Table 4 lists the countries of the comparison group in the geographical categories and includes the current level of CPI. The mean value of the CPI for these countries is 7.0%.

Table 4: Categories of the countries

Central and Eastern Europe	**Monetary policy regime**	**Current inflation (CPI) %**
Bulgaria	ER anchor	2.8
Latvia	ER anchor	3.5
Lithuania	ER anchor	4.4
Macedonia, FYR	ER anchor	-0.3
Developing Asia		
China	ER anchor	-0.7
India	OTHER	10.9
Pakistan	OTHER	13.6
Vietnam	ER anchor	7.1
Latin America and Caribbean		
Argentina	Monetary aggregate target	6.3
Haiti	Monetary aggregate target	0.0

Dominican Republic	OTHER	1.4
Bolivia	ER anchor	3.3
Nicaragua	ER anchor	3.7
Venezuela, RB	ER anchor	28.6
Paraguay	OTHER	2.6
Ecuador	ER anchor	5.2
Sub-Saharan Africa		
Kenya	Monetary aggregate target	9.2
Madagascar	Monetary aggregate target	9.0
Malawi	Monetary aggregate target	8.4
Mauritius	ER anchor	2.5
Nigeria	Monetary aggregate target	11.5
Uganda	Monetary aggregate target	13.4
Zambia	Monetary aggregate target	13.4

Source: (IMF 2008), (IMF 2011)

3. The financial crisis

Although this work does not have the ambition to judge the inevitability of the crisis as well as opposing issues that it might have been impossible to forecast, it does make remarks on the crisis itself relating it to the emerging market economies.

As Taylor suggests, the crisis was enhanced by the inappropriate monetary policy and says that the behaviour of Fed have not prevented the problems even though it could have. The crucial issue here is the interest rate which was not managed on the sufficient level. Taylor stands against the low level interest rate policy during the period of 2001 – 2005 and explains that the Fed did not follow the Taylor rule (Taylor 2009)[8].

The low levels of the interest rates supported the growth in the credit which was later enhanced through the rising prices of the housing in the USA (Naudé 2009). The issue of the mortgage lending and especially the subprime mortgage lending is seen as a cornerstone of the financial crisis issue. Financial organizations provided the mortgage services to the households which were unable to pay the loans back and would not be eligible for a standard mortgage nowadays. Institutions such as Fanny Mae and Freddie Mac assured the loans and as assets sold them on the financial markets. They worked with main Wall Street firms "and became the largest issuers of mortgage-backed securities" (Gerardi, et.al. 2010, 337). This action managed to spread the financial crisis once it was

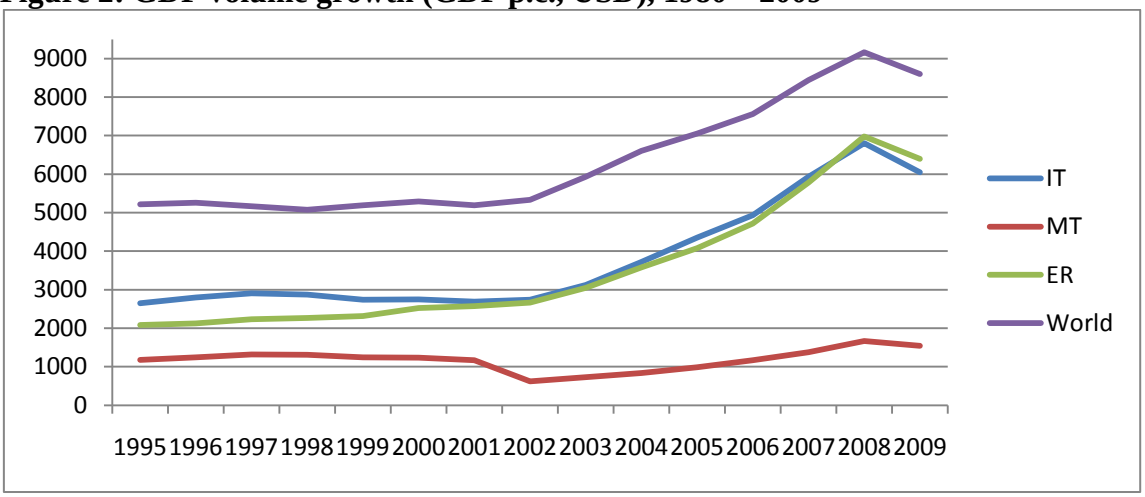
[8] Taylor rule as introduced in the previous part of the work.

clear that the institutions have crucial problems with the declining prices of the housing[9] and ability of the clients to repay their loans. The ongoing process escalated in September 2008 (although the severe foreclosures on the subprime mortgages lending emerged in summer 2007) when the Fanny Mae and Freddie Mac were nationalized by the US government (7.9.2008) followed by the bankruptcy of the Lehman Brothers (15.9.2008) (Naudé 2009). Panic, through large stock selling, dominated the financial sector and spread rapidly over the world because of the lack of evidence of the "infected" assets position in portfolios of the banks and other financial institutions. Following fear of the "counterparty risk" and declines in stock market and real estate prices further reduced the availability of the credit (Naudé 2009).

The financial interconnection among the countries affected with an instability and issues related to the financial crisis also the emerging market economies. The global financial market problems could have been translated into these countries although they adopted new approaches to secure their economies against swings in macroeconomic and financial field already prior the crisis (Braasch 2010). As Braasch suggests, the "global factors are increasingly important for domestic financial markets in the EMEs" (Braasch 2010, 2). The possibility to move financial resources from country to country without any restraints enables the stock markets to be correlated and e.g. the "equity correlations increase after liberalization of capital markets in emerging market economies" (Chung, et.al. 2010, 86). The World Bank data for the GDP p.c. (in current U.S. dollars) provide the following comparison of the GDP p.c. in different groups of countries depicted in figure 2. It shows that all the countries increased the GDP p.c. steadily over time. However, the division into the groups of different monetary policies show the difference between the MT countries and the IT and ER countries, which were closer to each other in terms of GDP p.c. volumes. Only the MT economies also faced a drop during the period, in 2002. MT economies followed increasing path after 2002 but in a more slowly manner than IT and ER countries. These two groups of economies went on similar path and all three categories hit the peak in 2008 from where the GDP p.c. had declined for all of them. Lower numbers are a consequence of the crisis behaviour of variables.

[9] Once the "bubble burst" in the 2006, it was clear that the prices of the mortgage do not reflect the actual price of the real estate (Naudé 2009).

Figure 2: GDP volume growth (GDP p.c., USD), 1980 – 2009



Source: (The World Bank 2011)

4. Comparison of the IT with other monetary policy regimes

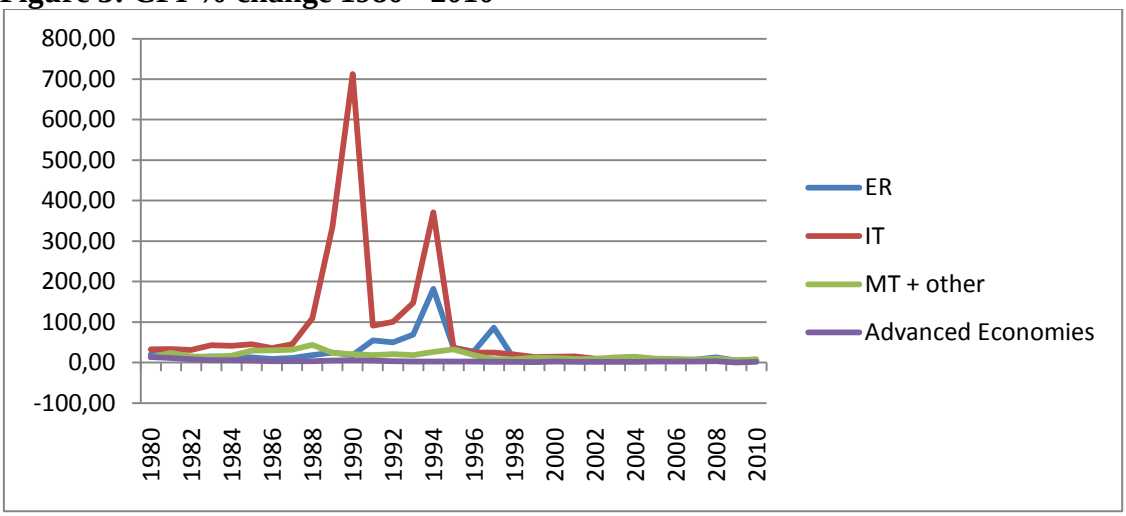
The main problem of the inflation targeting is the estimation of its outcome. For example Walsh refers to "good luck" which means that there is great uncertainty whether the positive evolution of the inflation state in the countries of our interest is not just a cause of overall "good times" in the world economy. To obtain the evidence of the inflation targeting influence on the macroeconomic outcomes of the country, the comparison with outcomes of a similar country that would differ only in the non implementation of the monetary regime is desirable. This is the most difficult part of the analysis since it is not easy to say "what would have happen if the inflation targeting had not been adopted" (Walsh 2009, 11, a). Evolution of the main economic variables follows in next sections.

4.1. GDP and CPI variables development

To enable the comparison of the groups of the countries, the development of the main economic variables is crucial to assess. Following graphs plot the GDP and CPI percentage changes of the emerging market economies from the 1980 to 2010.

4.1.1. CPI % change in volume development

Figure 3: CPI % change 1980 - 2010



Source: (IMF 2011), own calculations

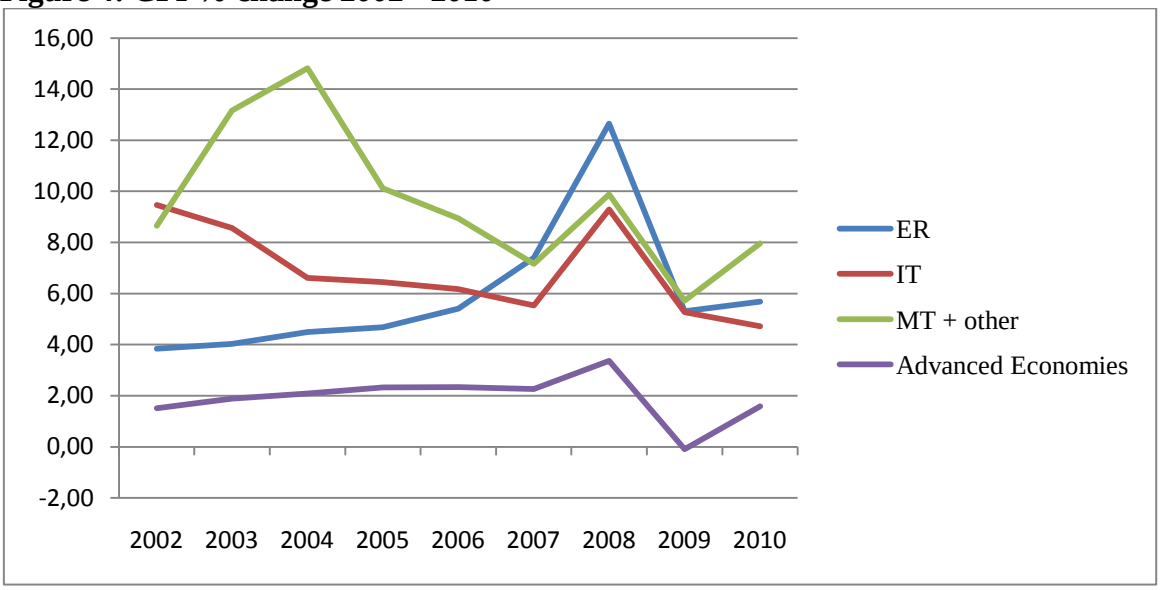
Advanced economies stand here for a benchmark to compare the situation in the rest of the world. The extreme values for the inflation targeting countries, which at the time of the peaks were not IT countries yet, are affected by Latin American countries such as Brazil, Peru, or also Armenia, which lacks a lot of observations. For example Brazil observations for the CPI ranged from 228.34% in 1987 to 2075.98% in 1994 with further sharp decline (66.01% in 1995). However, these extreme values are rather a cause of difficult "political economy" situation and decisions which affected the used monetary policy. The period of hyperinflation is linked to the New Republic era and presidency of Sarney (Kinzo 1993).

The period after the 2002 which is the average year to adopt the inflation targeting among those emerging markets, is a starting year to compare the particular regimes in detail. The values of the CPI percentage change are higher than among the advanced economies, which is in accordance to the expectations. For the IT countries, the line is smoother and declines over the time. Higher values around the year 2002 may be caused by the new adopters who faced the disinflationary phase and supported the decline from 9.46% in 2002 to 5.53% in 2007. The peak in CPI values in 2008, as shown in figure 4, emerged because of the high commodity and fuel prices countries faced from the beginning of the year 2008. The following trade and financial failures marked the upcoming crisis of period 2008 – 2010 (de Carvalho Filho 2010). The countries with the exchange rate anchor showed rising tendency over the whole decade and felt most sharply, compared to other regimes, during the crisis. Possibly severe situation is depicted by the Advanced Economies, which are a selection of different monetary policy regimes. It shows the state

of deflation that is the worst outcome for the economy facing the crisis while it can easily be "trapped" in the depression in the case that the zero or negative inflation rate would prevail for some longer period (Krugman 2010). However, the rising tendency is performed immediately after the bottom point had been hit.

The outcome of the IT countries is a good sign of the advantages it might bring to EMEs in terms of more stable inflation. This issue is further developed in the following sections of the work and will be enhanced by the empirical analysis.

Figure 4: CPI % change 2002 - 2010



Source: (IMF 2011), own calculations

Regarding the volatility of the CPI inflation performed by the three categories of the monetary policy approaches, the IT countries showed the lowest values of the standard deviation during the time period 2002 – 2010. On the other hand, using the range of 1980-2010, the countries which are later on assumed as IT economies, exhibited the highest values of the standard deviation. The values are shown in table 5.

Table 5: Standard deviation of CPI observations

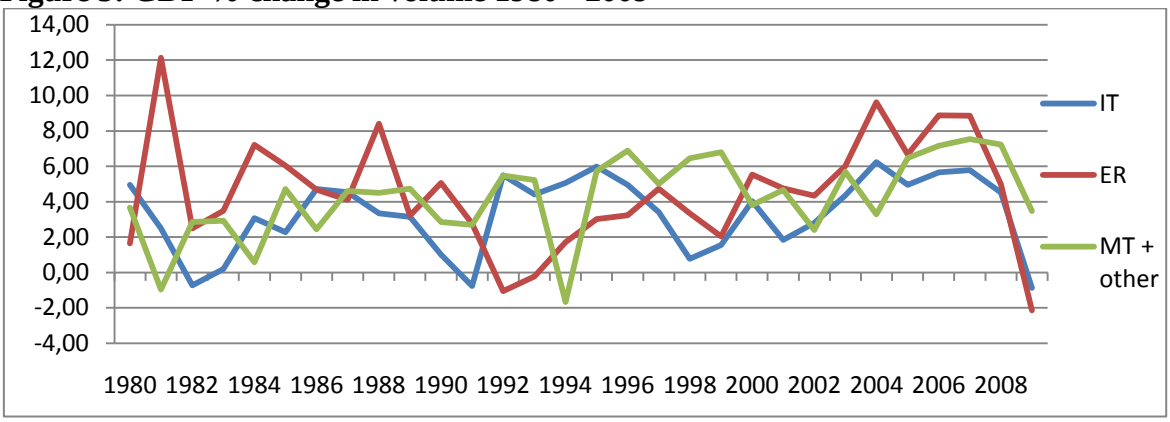
Standard deviation, observations 1980 - 2010		Standard deviation, observations 2002 - 2010	
ER	68.41	ER	3.90
IT	186.70	IT	3.50
MT + other	16.17	MT + other	5.69

Source: (IMF 2011), own calculations

4.1.2. GDP % change in volume development

The figure 5 presents the evolution of the GDP percentage change over the period of 1980 – 2009 and shows the comparison of the emerging countries with each other. Those observations are delivered by the table 6.

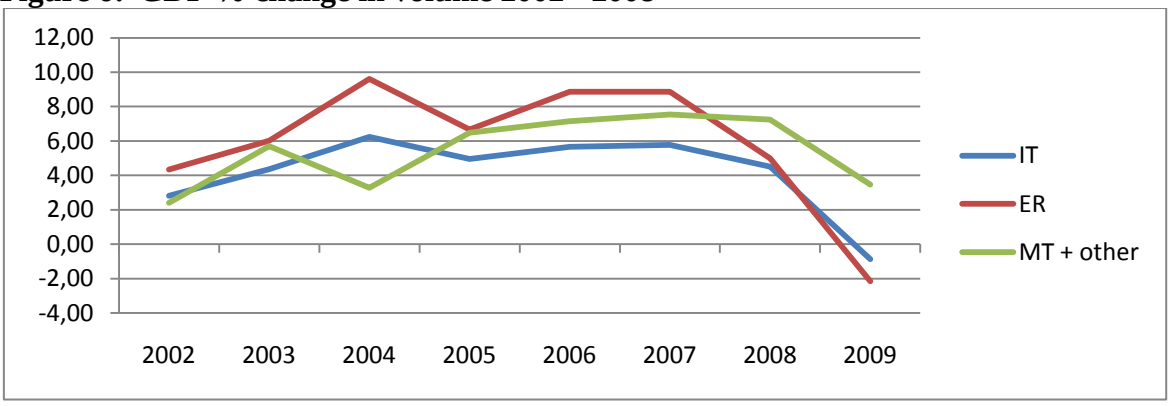
Figure 5: GDP % change in volume 1980 - 2009



Source: (IMF 2011); own calculations

All the three representatives of different monetary policies in EMEs show significant changes and instability in the annual percentage changes in volume. Countries with the exchange rate (ER) anchor appear to have gone through the peaks and bottoms of the highest magnitude. This holds especially for the year 1981, where it displayed values of 12% changes while other regimes were under the zero axis showing negative values of almost 1%. ER anchor economies also faced more than -2% changes during the crisis period while IT followed with values around -1% and monetary aggregate targeting (MT) plus other regimes stayed in the positive numbers. All of the frameworks performed similarly negative GDP percentage changes during the first half of the 1990s.

Figure 6: GDP % change in volume 2002 - 2008



Source (IMF 2011); own calculations

There is again present the declining trend for the years of the financial crisis starting approximately in the half of the year 2007. Although other regimes show higher values than the IT regime, it was steadily increasing the values of the GDP percentage volume change through years 2002 – 2004. This was followed by 1% decline but in 2006 the values were back closely to 6% and remained stable until the crisis. The depicted decline has been most severe for the ER anchor countries, followed by the IT economies.

Table 6: Standard deviations of GDP observations

Standard deviation, observations 1980 - 2009		Standard deviation, observations 2002 - 2009	
IT	4.78	IT	3.02
ER	6.12	ER	4.69
MT + others	5.07	MT + others	2.95

Source: (IMF 2011); own calculations

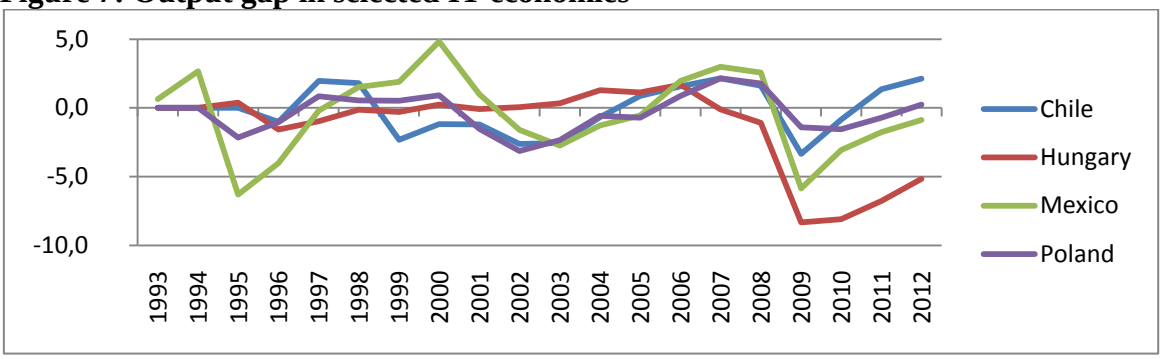
Table 6 presents the standard deviation data for each monetary policy framework to compare the volatility of the GDP percentage changes. IT economies show on average lower volatility than other regimes, which might be the benefit from the monetary policy as such. On the other hand, the data for the period 2002-2009 present even lower volatility for the MT and others. This result might be caused by the lower number of observations, since data for more MT countries were missing for this period. On average, all the countries performed lower volatility than in the longer time framework. Further analysis should state whether the data used support the hypothesis, that the lower volatility in IT economies is caused by the regime used.

4.2. The evolution of the output gap

One of the indicators used to access the monetary policy and as a signal of economic activity is the output gap. It shows the distance of the economy from the state of the "full employment or potential level" (Billi 2011, 63). The potential level of the product, "characterizes aggregate supply (production capacity) of the national economy and corresponds to the level of the output for given level of technology and of the output level with the full employment of the production factors" (Kadeřábková a Žďárek 2007, 11). The measurements of the output gap might be more difficult to proceed than those of the GDP levels, since the potential product is unobservable.

The OECD data are limited for the non-OECD countries therefore the evolution of the output gap is here illustrated on the sample of inflation targeting countries including Chile, Hungary, Mexico and Poland in figure 7.

Figure 7: Output gap in selected IT economies



Source: (OECD 2010)

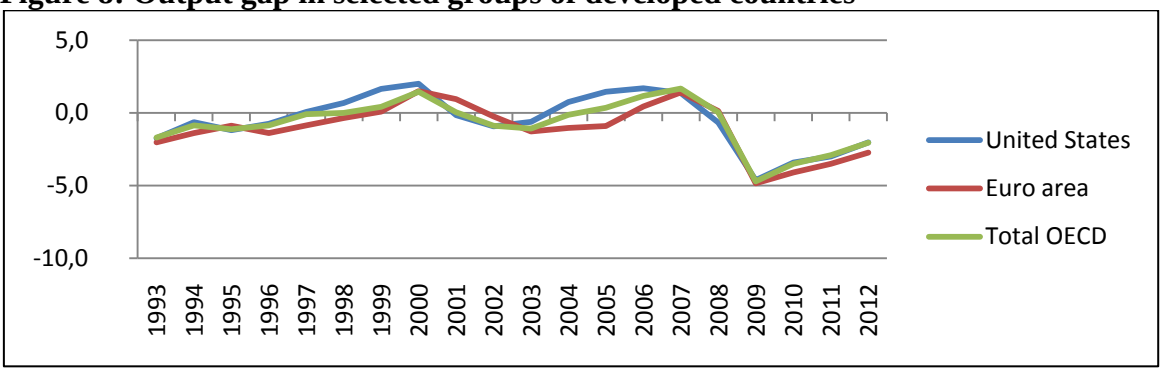
Table 7: Output gap means (ITs)

Output gap (mean)							
Chile	-0.38	Hungary	-0.97	Mexico	-0.31	Poland	-0.42

Source: (OECD 2010)

The output gap behaved during the time in similar way for those four countries. Main problems with bigger negative and positive gaps experienced Mexico, especially in 1995 and 2000. All countries had significantly negative output gap during the time of the crisis and prediction shows possible movements towards the neutral state and later on towards the positive output gap. Negative output gap means the situation when the actual output is lower than the potential output of the economy. In this case the economy does not exploit all its possibilities, whole potential. Literature suggests that for the output gap of the positive sign, the inflation pressures in the economy would rise (Kadeřábková a Žďárek 2007). To enable the comparison with advanced countries, figure 8 follows.

Figure 8: Output gap in selected groups of developed countries



Source: (OECD 2010)

Table 8: Output gap means (developed)

Output gap (mean)					
United States	-0.5	Euro area	-1.1	Total OECD	-0.7

Source: (OECD 2010)

Although the means of the countries are again of the negative sign, this is probably distortion by the data for the crisis period. Usually the values of the output gap for these groups of countries were not reaching negative output gap of such a magnitude as the selected IT countries did during the 1990´s. The above listed IT countries adopted this monetary regime in 1999 (Chile), 2001 (Hungary), 2001 (Mexico), 1999 (Poland) (as listed in the table 2). The simple comparison of data shows that the IT countries had more severe problems with the volatility of the output gap. That has happened more often and with higher level of the output gap than in the developed countries. However while controlling for the mean of the average output gap performance of the countries, the output gap is -0.7 (% of the potential output) for both the group of IT economies and group of the developed ones. Figure 8 shows the output gaps in the time of the crisis.

Assuming the inflation targeting as a "decision making under discretion" (Bernanke and Woodford 2005, 20), it would be characterised by precise objective, stabilization of inflation around the target and also stabilization of output gap around some target. This target is supposed to be modified to equal 0 to be consistent with the natural rate of the output level. These actions should "eliminate average inflation bias" (Bernanke and Woodford 2005, 20). Therefore the standard deviation could be more predicative than the means of the output gap and are presented in table 9.

Table 9: Output gap – standard deviation (selected IT and advanced countries)

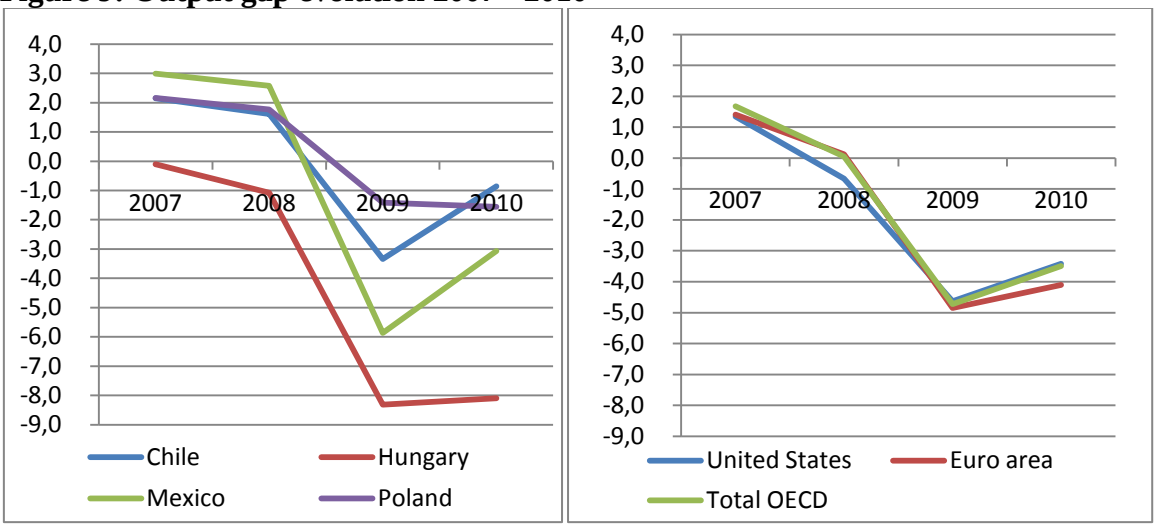
Output gap (standard deviation)			
	1999-2007	2008-2012	2008-2010
Chile	1.80	2.28	2.48
Hungary	0.71	2.96	4.11
Mexico	2.44	3.09	4.30
Poland	1.71	1.38	1.88
mean	1.66	2.43	3.19
United States	1.09	1.49	2.03
Euro Area	1.05	1.92	2.68
Total OECD	0.97	1.78	2.48
mean	1.04	1.73	2.40

Source: (OECD 2010)

The variability of the output gap for selected IT EMEs is higher than for the advanced economies and it increased for the crisis period. This is in line with the characteristics of the crisis that assume worsening of economic variables. However, the comparison with the

emerging non-IT economies is missing since the OECD database does not include data for those countries.

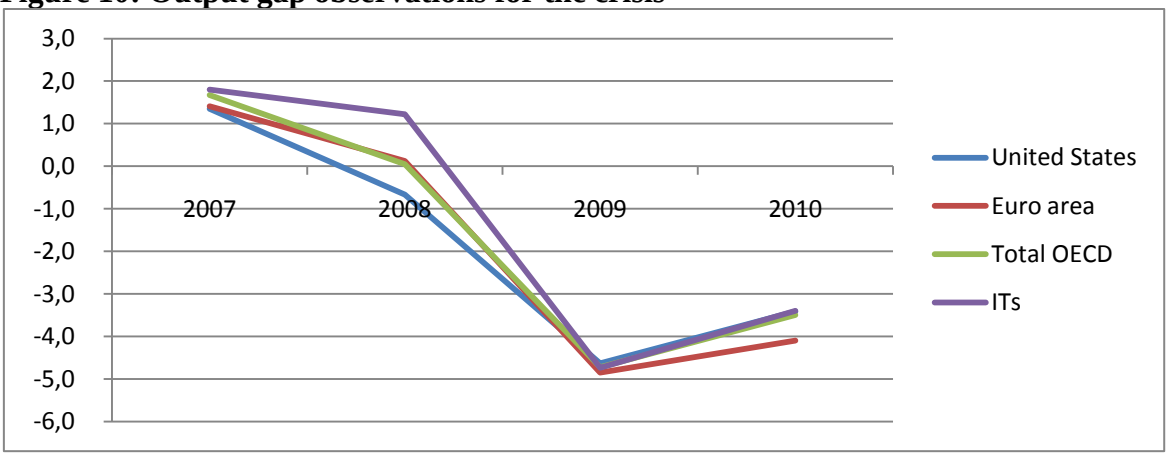
Figure 9: Output gap evolution 2007 - 2010



Source: (OECD 2010)

The chart illustrates certain countries such as for example Chile and Poland were successful in terms of small output gap size. However, those are only two countries against the biggest non-targeters.[10] Inserting the average output gap performance of these IT countries for the 2007 – 2010 period into the chart with the developed countries (figure 10), their overall good performance is demonstrated.

Figure 10: Output gap observations for the crisis



Source: (OECD 2010)

[10] Assuming especially the USA and the Euro area, because the OECD group also contains other developed countries performing inflation targeting. Therefore the USA and Euro area can stand here as an opposite group in terms of use of other monetary policy than IT.

This also nicely illustrates an onset of the crisis in mid 2008 and its peak in 2009. Selected IT economies were slightly above the performance of the Euro area and the USA before the crisis and remained in this distance until the bottom point in 2009 where the levels were nearly equalled for all the groups. However, their recovery went on the same line as for the USA and the OECD countries but still performing smaller negative output gap.

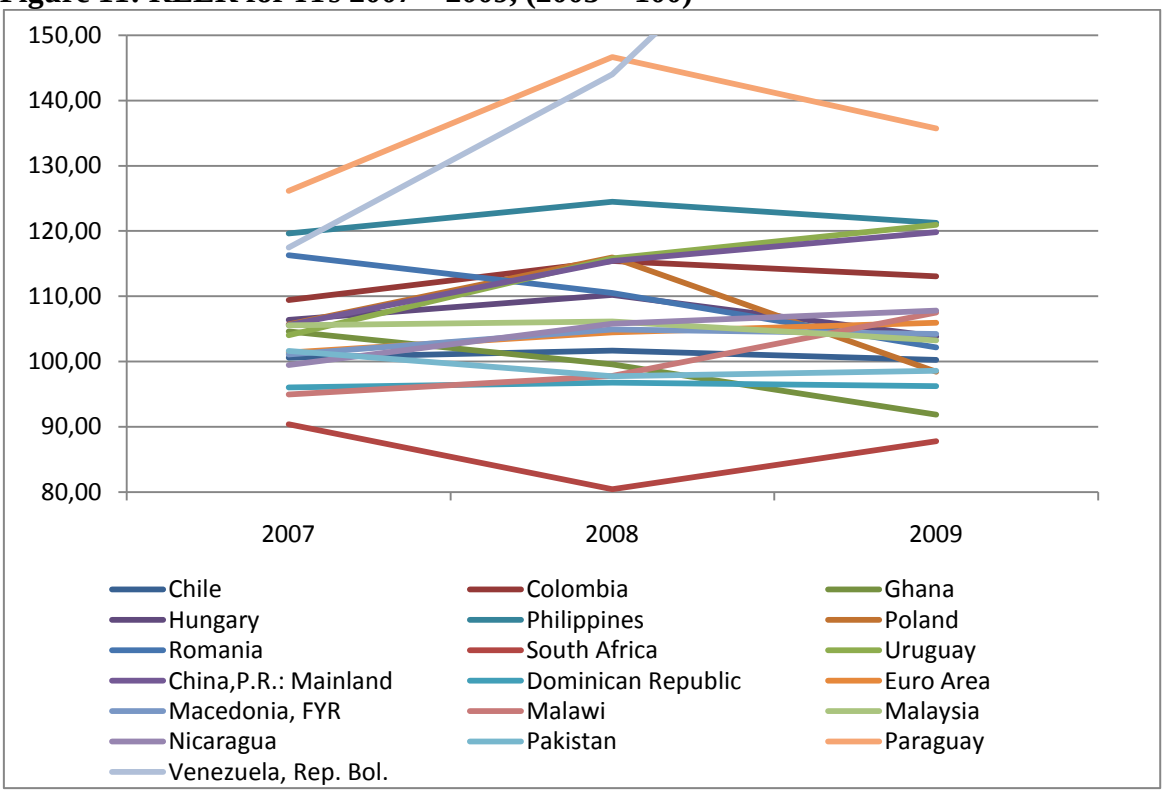
4.3. Real effective exchange rate

The real effective exchange rate (REER) is the index measuring the change in the purchasing power of the currency. Usually is the REER determined by the use of the weighted geometric mean of the ratio of nominal effective exchange rate in the particular country and price indexes of "partner" countries towards the country´s (national) change in prices.[11] The IFS REER data are retrieved from the "relative unit labour costs and relative normalized unit labour costs" (IMF 2008, 3). Issues such as the "importance of a country´s trading partners in its direct bilateral relations with them (in both home and foreign markets), of the competitive relations with third countries in particular markets and of the differences among countries in the importance of foreign trade to the manufacturing sector" (IMF 2008, 3) are assumed being relevant for the index creation. Therefore can be the REER presented as one of the measures of the country´s competitiveness.

Simply said, the real appreciation of the national currency to the foreign one affects the trade while the exporters face more difficult position than importers. The price of exports to another country increases and therefore national exporters´ competitiveness decreases. In this situation, the imports from the other country are cheaper. This condition applies vice versa for depreciation of the national currency to the foreign one (Kadeřábková 2002). Therefore in the situation of stronger exchange rate country´s trade balance might be lower. Using this assumption, the data for the REER during the crisis can be assessed and displayed in the figure 10: Comparison of the IT, non-IT EMEs and the Euro Area.

[11] (Kadeřábková 2002, 98); Or: "weighted average of relative prices of a country with its main trade competitors" (IMF 2008, 3)

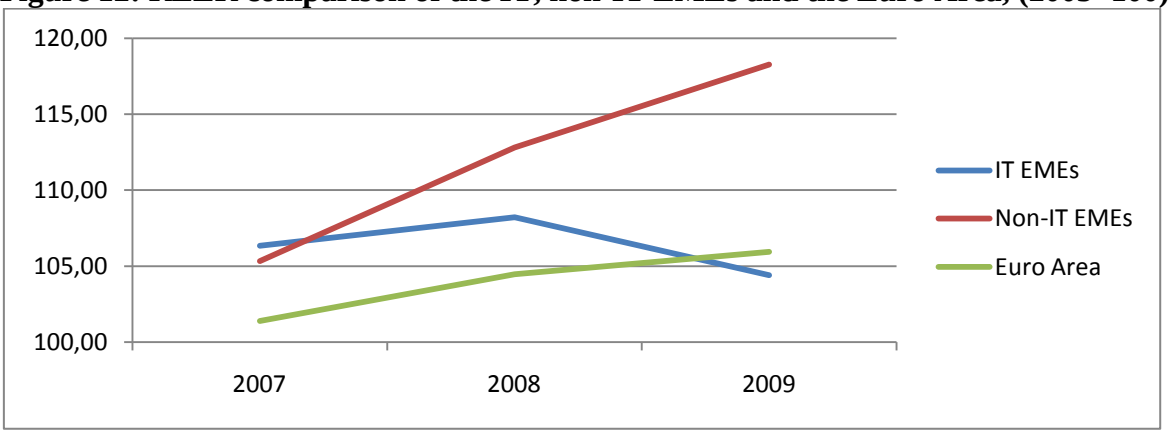
Figure 11: REER for ITs 2007 – 2009, (2005 = 100)



Source: (IMF 2011); own calculations

The real effective exchange rate data shows how the countries maintained this crucial economic variable through the crisis period. Annual data for 2007 to 2009 were used to make the first overlook in the figure 11.

Figure 12: REER comparison of the IT, non-IT EMEs and the Euro Area, (2005=100)



Source: (IMF 2011); own calculations

The real effective exchange rate, as shown in figure 12, changed smoothly for the Euro area countries. The non-ITs comparable to our IT countries followed reverse path from the 2008 when it started to increase sharply. IT economies experienced slightly increasing trend with the peak in 2008 than it decreased slowly beneath the Euro Area values.

This could be a sign of ability of this regime to perform better outcomes in terms of balance of trade during the crisis.

The relevant literature suggests that the inflation targeting outcomes are difficult to assess. For example Issing (Issing 2004, 171) says that the inflation targeting is hard to compare with another monetary policy regimes since the definition of the IT is not that specific to enable the empirical evaluation of its advantages or disadvantages. Demertzis and Viegi (Demertzis and Viegi 2008, 57) add to the discussion that the models conventionally used for monetary policy description lack the differences for description of the inflation targeting and other strategies (Walsh 2009, a).[12]

The work aims to find the way such a comparison of the monetary policy regimes could be done and to point out effects of the inflation targeting. Suitable approach can be the difference-in-differences approach to which e.g. the Goncalves and Sales paper applies.

5. Difference in differences approach

"Difference-in-differences estimator is the methodology for uncovering the impact of specific policy changes or economic shocks on the market outcomes" (Borgas 2005, 64).

One of the corresponding methods to compare the IT countries to the economies which use other monetary policies is the difference-in-difference approach. Usually the method is used for two periods of time and two groups. These groups are a comparison group, the non-targeting countries in this case, and a treatment group, the IT economies. The estimate of the treatment effect could be defined while taking difference of the outcomes for the representatives of the comparison group, as well as of the treatment group, before the assigned treatment (inflation targeting regime adoption) and after the treatment. From the average change in the outcomes, after treatment values minus before treatment values, of the comparison and treatment groups, the difference is taken for another time. This procedure should be suitable for the purposes of this work since "the first difference removes the offending unobserved heterogeneity and restores conditional independence, while the second produces the impact estimates." (Essama-Nssah 2006, 17)[13]

[12] There is this no explicit analysis of the way the provision of a specific numerical target may constitute a better anchor for private-sector expectations (Walsh 2009, 21, a).

[13] „the DD method is two-step procedure that relies on differencing to control for unobservable heterogeneity stemming from fixed effects, and on averaging to control for observed heterogeneity" (Essama-Nssah 2006, 19).

Regarding the periods of time used, the first one is the period from 1990 to 2005, 2007 respectively, and the second one is from 2005 (2007) to 2010, or 2009 in dependence on the data availability. The 1990 is stated as a benchmark for the IT economies since it is the year the first of the countries implemented this policy. According to the theory, the comparison group should not be under the treatment, the inflation targeting here, in any of those two periods. The treatment group should not be under the treatment in one of those periods here it is the first period of 1990 – 2002 and should be under the treatment in the other one, here the second period (Ball and Sheridan 2003).

The difference in differences approach is used to define the regression which should deliver the data estimates on variables of the interest and thus enable to assess the impact and effects of the inflation targeting on the emerging market economies. Since the performance of the IT countries can be evaluated using the behavioural observations of e.g. level and variability of the inflation, pace and variability of the GDP etc., these variables might be used in the differences regression. As the Ball and Sheridan suggest, the regression for these purposes might be stated in following way:

$$V_1 - V_0 = x_0 + x_1 D + x_2 V_1 + \varepsilon,$$

where V_1 is the value of variable of the interest after the inflation targeting, in the second period. V_0 is the value of the variable of the interest before the inflation targeting implementation, in the first period. D stands here for the dummy variable which takes the value of 0 if the country is a non-IT economy and value of 1 if the country is the IT economy. ε is the error term.

The data are then used in the OLS regression proceeded in the Gretl software[14] to obtain the outcomes of the model.

5.1. CPI percentage change in volume estimations

Using the IMF IFS data for the CPI percentage change with the annual observations, the groups of countries were analysed in the so called beginning period, denoted B in the table and the chart, and final period, denoted F. C stands here for the change, the final period value minus beginning period value. The values of the periods are the annual CPI percentage changes in volumes in each country. Regarding the period B, this is the year 1990 and the F stands for the year 2005. Later on, the data for the final period of 2007 are used in the model 2. Data for the following models 1 and 2 are displayed in the table 10.

[14] Software package for econometric analysis, free software, more information: http://gretl.sourceforge.net/.

Table 10: CPI % change - model 1 and 2 data

Country	Beginning 1990	Final 2005	Change	Final 2007	Change
IT					
Indonesia	7,81	10,45	2,64	6,32	-1,49
Philippines	12,68	7,63	-5,05	2,83	-9,85
Thailand	5,86	4,54	-1,32	2,28	-3,59
Hungary	28,97	3,55	-25,42	7,93	-21,04
Poland	555,38	2,11	-553,27	2,39	-552,99
Turkey	60,31	10,14	-50,17	8,76	-51,56
Ghana	37,26	15,12	-22,14	10,73	-26,53
South Africa	14,32	3,40	-10,92	7,10	-7,22
Brazil	2947,73	6,87	2940,86	3,64	2944,09
Chile	26,03	3,05	-22,98	4,41	-21,62
Colombia	29,15	5,05	-24,10	5,54	-23,60
Guatemala	41,22	8,42	-32,80	6,45	-34,77
Mexico	26,65	3,99	-22,67	3,97	-22,69
Peru	7481,66	1,62	7480,04	1,78	7479,88
Uruguay	112,53	4,70	-107,83	8,11	-104,41
Mean	759,17	6,04	**-753,13**	5,48	**-753,69**
Non-IT					
China,P.R.: Mainland	3,06	1,82	-1,24	4,75	1,69
China,P.R.:Macao	7,97	4,40	-3,57	5,57	-2,40
India	8,97	4,25	-4,72	6,37	-2,60
Malaysia	2,62	2,96	0,34	2,03	-0,59
Maldives	3,62	1,30	-2,32	6,79	3,17
Pakistan	9,05	9,06	0,01	7,60	-1,45
Bulgaria	23,80	5,04	-18,76	8,40	-15,40
Kenya	17,78	10,31	-7,47	9,76	-8,02
Madagascar	11,78	18,51	6,73	10,30	-1,48
Malawi	11,82	15,41	3,59	7,95	-3,87
Mauritius	13,49	4,94	-8,55	8,80	-4,69
Argentina	2313,96	9,64	2304,32	8,83	2305,13
Dominican Republic	50,46	4,19	-46,27	6,14	-44,32
Haiti	21,28	15,73	-5,55	8,53	-12,75
Nicaragua	7485,49	9,60	7475,89	11,13	7474,36
Paraguay	37,26	6,81	-30,45	8,13	-29,13
Venezuela, Rep. Bol.	40,66	15,95	-24,70	18,70	-21,96
Mean	591,95	8,23	**-583,71**	8,22	**-583,72**

Source: (IMF 2011); own calculations

Model 1: OLS, using observations 1-32, Dependent variable: Change,
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	8,33042	1,41312	5,8951	<0,00001	***
B	-1,00017	0,000304054	-3289,4456	<0,00001	***
D	-2,16093	1,63947	-1,3181	0,19780	

Mean dependent var	-663,1278	S.D. dependent var	1901,234
Sum squared resid	659,5996	S.E. of regression	4,769152
R-squared	0,999994	Adjusted R-squared	0,999994
F(2, 29)	5571526	P-value(F)	1,05e-81
Log-likelihood	-93,82039	Akaike criterion	193,6408
Schwarz criterion	198,0380	Hannan-Quinn	195,0983

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 5,20624 with p-value = P(Chi-Square(4) > 5,20624) = 0,266783

Model 1 for the data of years 1990 and 2005 show expected negative value of the dummy coefficient but it is above the significance levels. The dummy coefficient is of the main importance in these models. When significant, the coefficient would show the percentage change of the CPI that can be assigned to the inflation targeting regime as its effect. Here it would mean 2.2 % decline in CPI for the IT compared to the non-IT EMEs. According to the White´s test, the heteroskedasticity is not present since the null hypothesis cannot be rejected.

Model 2: OLS, using observations 1-32, Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	8,27917	0,896643	9,2335	<0,00001	***
B	-1,0001	0,000317378	-3151,1162	<0,00001	***
D	-2,72411	1,10908	-2,4562	0,02027	**

Mean dependent var	-663,3944	S.D. dependent var	1901,106
Sum squared resid	295,3905	S.E. of regression	3,191533
R-squared	0,999997	Adjusted R-squared	0,999997
F(2, 29)	4964776	P-value(F)	5,61e-81
Log-likelihood	-80,96703	Akaike criterion	167,9341
Schwarz criterion	172,3313	Hannan-Quinn	169,3916

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 0,804015 with p-value = P(Chi-Square(4) > 0,804015) = 0,937909

Model 2 uses data for the years 1990 and 2007 to increase the number of the observations included and also to approach the year assumed to be the beginning of the crisis. The Model 2 displays coefficient for the dummy D of -2.72411 with the p-value of 0.02027, therefore lower than the 0.05 (5%) level of significance. It can be stated that the dummy, the being IT country, had an effect of approximately 2.72 % decrease of the CPI over the period. There were missing data for few countries in years 1990 – 1995 (inclusive) and the data also were influenced by the hyperinflation in some of the countries. Therefore the same procedure as presented above is done for the year 1996 as a beginning year and 2005 (2007) for the final and it can be seen as a robustness check to support previous findings. Outcomes of the regressions are represented by the models 3 and 4.

Model 3: OLS, using observations 1-39, Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	6,0223	1,13106	5,3245	<0,00001	***
B	-0,92792	0,0373048	-24,8740	<0,00001	***
D	-1,364	1,44723	-0,9425	0,35222	

Mean dependent var	-16,24896	S.D. dependent var	26,93203
Sum squared resid	709,6528	S.E. of regression	4,439885
R-squared	0,974253	Adjusted R-squared	0,972823
F(2, 36)	369,3735	P-value(F)	1,02e-24
Log-likelihood	-111,9123	Akaike criterion	229,8246
Schwarz criterion	234,8152	Hannan-Quinn	231,6152

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 9,20109 with p-value = P(Chi-Square(4) > 9,20109) = 0,056265

Regarding the model 3, dummy coefficient is not statistically significant but still of the expected negative sign. The null hypotheses of the non-presence of the heteroskedasticity can be rejected on the 0.10 (10%) significance level. Therefore the estimates might lose some of their optimal properties.

Model 4: OLS, using observations 1-39, Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	6,87002	0,594558	11,5548	<0,00001	***
B	-0,946407	0,025992	-36,4115	<0,00001	***
D	-2,92953	0,8858	-3,3072	0,00214	***

Mean dependent var	-16,55496	S.D. dependent var	27,34034
Sum squared resid	245,4224	S.E. of regression	2,610994
R-squared	0,991360	Adjusted R-squared	0,990880
F(2, 36)	952,4771	P-value(F)	6,75e-32
Log-likelihood	-91,20728	Akaike criterion	188,4146
Schwarz criterion	193,4052	Hannan-Quinn	190,2052

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 17,7384 with p-value = P(Chi-Square(4) > 17,7384) = 0,00138816

Model 4 displays the data for the years 1996 and 2007. The value of the dummy coefficient is of the negative sign, which is in accordance with the assumption that the IT regime would be lowering the CPI more than other regimes and also highly significant (even on the 1% level of significance). However, the null hypothesis for heteroskedasticity can be rejected therefore the hypothesis that the heteroskedasticty is not present does not hold.
The behaviour of the estimates would show whether the effects of the IT is present. The coefficient of the dummy should be in this case of the positive value. Since the main concern of the monetary policy authority is to maintain positive and stable inflation levels rather than to face the problems delivered by the possible deflation, negative levels of inflation.

Taking the values for years 2005 (B2005) and 2009, the model 5 presents following information. Low but positive coefficient values are delivered by the model, however the coefficient is not significant in this case. Also the null hypothesis can be rejected therefore the heteroskedasticity might be present in the model. Data for models 5 and 6 are depicted in the following table 11.

Table 11: CPI % change - model 5 and 6 data

Country	Beginning 2005	Final 2009	Change	Beginning 2007	Change
IT					
Indonesia	10,45	6,39	-4,07	6,32	0,07
Philippines	7,63	3,23	-4,40	2,83	0,40
Thailand	4,54	-0,85	-5,39	2,28	-3,13
Albania	2,37	2,28	-0,09	2,93	-0,65
Hungary	3,55	4,21	0,66	7,93	-3,73
Poland	2,11	3,83	1,72	2,39	1,44
Romania	8,99	5,59	-3,40	4,84	0,75
Serbia, Republic of	16,12	7,78	-8,34	6,39	1,39
Turkey	10,14	6,25	-3,89	8,76	-2,51
Ghana	15,12	19,25	4,13	10,73	8,52
South Africa	3,40	7,13	3,73	7,10	0,03
Brazil	6,87	4,89	-1,98	3,64	1,25
Chile	3,05	1,48	-1,57	4,41	-2,93
Colombia	5,05	4,20	-0,85	5,54	-1,34
Guatemala	8,42	1,86	-6,56	6,45	-4,60
Mexico	3,99	5,30	1,31	3,97	1,33
Peru	1,62	2,94	1,32	1,78	1,16
Uruguay	4,70	7,10	2,40	8,11	-1,02
Mean	6,56	5,16	**-1,40**	5,36	**-0,20**
Non-IT					
China,P.R.: Mainland	1,82	-0,70	-2,52	4,75	-5,45
China,P.R.:Macao	4,40	1,17	-3,23	5,57	-4,40
India	4,25	10,88	6,63	6,37	4,51
Malaysia	2,96	0,58	-2,38	2,03	-1,44
Maldives	1,30	4,54	3,24	6,79	-2,25
Pakistan	9,06	13,65	4,58	7,60	6,05
Vietnam	8,28	7,05	-1,23	8,30	-1,25
Bulgaria	5,04	2,75	-2,29	8,40	-5,65
Latvia	6,74	3,53	-3,22	10,11	-6,58
Lithuania	2,67	4,45	1,78	5,75	-1,30
Macedonia, FYR	0,16	-0,27	-0,43	3,61	-3,88
Kenya	10,31	9,23	-1,08	9,76	-0,52
Madagascar	18,51	8,96	-9,56	10,30	-1,34
Malawi	15,41	8,42	-6,99	7,95	0,47
Mauritius	4,94	2,55	-2,39	8,80	-6,25
Argentina	9,64	6,27	-3,37	8,83	-2,56
Dominican Republic	4,19	1,44	-2,75	6,14	-4,70
Haiti	15,73	-0,01	-15,74	8,53	-8,54
Nicaragua	9,60	3,69	-5,91	11,13	-7,44
Paraguay	6,81	2,59	-4,22	8,13	-5,54
Venezuela, Rep. Bol.	15,95	28,59	12,63	18,70	9,89
Mean	7,51	5,68	**-1,83**	7,98	**-2,30**

Source: (IMF 2011); own calculations

Model 5: OLS, using observations 1-39, Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
const	0,784839	1,2932	0,6069	0,54773
B2005	-0,348006	0,241853	-1,4389	0,15881
D	0,0948009	1,35453	0,0700	0,94459

Mean dependent var	-1,633158	S.D. dependent var	4,854173
Sum squared resid	788,3797	S.E. of regression	4,679683
R-squared	0,119516	Adjusted R-squared	0,070601
F(2, 36)	1,125809	P-value(F)	0,335543
Log-likelihood	-113,9638	Akaike criterion	233,9275
Schwarz criterion	238,9182	Hannan-Quinn	235,7181

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 11,2653 with p-value = P(Chi-Square(4) > 11,2653) = 0,0237392

Model 6: OLS, using observations 1-39, Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-5,37066	2,36747	-2,2685	0,02939	**
B2007	0,385468	0,318785	1,2092	0,23448	
D	3,10854	1,33571	2,3273	0,02569	**

Mean dependent var	-1,327155	S.D. dependent var	4,005729
Sum squared resid	517,5465	S.E. of regression	3,791608
R-squared	0,151205	Adjusted R-squared	0,104050
F(2, 36)	2,712202	P-value(F)	0,079953
Log-likelihood	-105,7566	Akaike criterion	217,5132
Schwarz criterion	222,5039	Hannan-Quinn	219,3038

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 12,9658 with p-value = P(Chi-Square(4) > 12,9658) = 0,011444

Model 6 delivers the results supporting the hypothesis that the inflation levels were of positive values. It shows 3.1% increase in CPI for the IT countries and the outcome is significant on the 0.05 (5%) level. However, the possibility of presence of the heteroskedasticity exists. Again the null hypothesis can be rejected according to the White´s test.

Both tables 10 and 11 show the data that were used for the composition of the model. However, the means of the values present the higher difference between the final and the beginning value of the CPI for the IT countries only in the pre-crisis period, table 10. The results are very similar for both final years 2005 and 2007. For the purposes of this work,

the final year 2007 is more important because it represents the beginning of the crisis period. This simple comparison of the CPI % falls needs to be accompanied with the regressions presented because the IT data on CPI show higher values in the beginning periods than the non-IT countries. Therefore the higher difference between the periods for ITs could stand for the "tendency for this variable to revert to its mean" (Goncalvas and Salles 2008, 313).

Table 11 includes 4 more observations for the countries which lack data for the beginning year 1990. Use of the beginning year of 2007 (2005 stands here as a comparison for the Goncalves et al work, since their observations ended with the year 2005) and final of the 2009 (2010 was used as well but there were not data available to all countries of the sample and in many cases the data were only expected values) underlines the period of the financial crisis. The IT regime should help the countries to maintain low and stable inflation but at the same time prevent the threat of deflation. Although the data for the fall in CPI are again of the negative values for the ITs, they are of smaller magnitude than those for the non-ITs and therefore inflation targeting should help with the above described maintenance of the CPI more significantly than other regimes.

Outcomes of the models presented in this section are summarized in the table 12. It includes also the results for the models that are not displayed here to enable to evaluate why those were omitted. Usually for those models, the fit of the data represented by the R^2 values is small (especially model 5 and 6).

Table 12: CPI % change - outcomes of the models

model	**constant**	p-value	**dummy D**	p-value	**begin. B**	p-value	**R^2**	observ.
1 (1990 - 2005)	8,33	<0,00001	-2,1600	0,19780	-1,000	<0,00001	0,99	32
2 (1990 - 2007)	8,28	<0,00001	-2,7200	0,02027	-1,000	<0,00001	0,99	32
3 (1996 - 2005)	6,02	<0,00001	-1,3640	0,35220	-0,927	<0,00001	0,97	39
4 (1996 - 2007)	6,87	<0,00001	-2,9295	0,00214	-0,946	<0,00001	0,99	39
5 (2005 - 2009)	0,78	0,54700	0,0948	0,94000	-0,348	0,15800	0,07	39
6 (2007 - 2009)	-5,37	0,02900	3,1085	0,02569	0,385	0,23400	0,10	39

Source: (IMF 2011); own calculations

The models were then also run separately for the categories of the countries. The table 13 displays the estimates from the regressions for the IT and non-IT countries as categorised in table 4 above.

Table 13: CPI % change - outcomes of the models for the country categories

Countries category								
Central and Eastern Europe								
model	**constant**	p-value	**dummy D**	p-value	**begin. B**	p-value	**R^2**	observ.
(1995 - 2005)	-0,87350	0,70429	2,44870	0,25236	-0,83415	<0,00001	0,98	10
(1995 - 2007)	5,04352	0,02824	-1,89867	0,27237	-0,94622	<0,00001	0,99	10
(2005 - 2010)	0,56805	0,57972	3,46820	0,03788	-0,82714	0,00026	0,79	10
(2007 - 2010)	-0,40680	0,84986	4,41247	0,01066	-0,76941	0,04455	0,74	10
Developing Asia								
model	**constant**	p-value	**dummy D**	p-value	**begin. B**	p-value	**R^2**	observ.
(1990 - 2005)	1,40439	0,34299	1,84550	0,46375	-0,51165	0,11074	0,1	8
(1990 - 2007)	3,18824	0,14622	-2,25878	0,21159	-0,67230	0,04008	0,64	8
(2005 - 2010)	2,77008	0,56685	-5,83853	0,06098	-0,12239	0,83588	0,24	8
(2007 - 2010)	0,69822	0,82659	-1,70852	0,55401	0,19726	0,69836	-0,22	8
Latin America and Caribbean								
model	**constant**	p-value	**dummy D**	p-value	**begin. B**	p-value	**R^2**	observ.
(1990 - 2005)	10,76130	0,00103	-5,54280	0,02987	-1,00027	<0,00001	0,99	13
(1990 - 2007)	10,64640	0,00071	-5,43278	0,02438	-1,00024	<0,00001	0,99	13
(2005 - 2009)	-2,75687	0,64135	2,12796	0,37694	-0,04537	0,96131	-0,15	13
(2007 - 2009)	12,20080	0,01856	7,04446	0,02464	0,88378	0,09706	0,29	13
Sub-Saharan Africa								
model	**constant**	p-value	**dummy D**	p-value	**begin. B**	p-value	**R^2**	observ.
(1990 - 2005)	7,02994	0,25157	-7,66725	0,17058	-0,61628	0,02900	0,59	6
(1990 - 2007)	7,08671	0,00339	-2,15056	0,01546	-0,84570	0,00002	0,98	6
(2005 - 2010)	-0,38851	0,71992	3,15585	0,01327	-0,49028	0,00240	0,96	6
(2007 - 2010)	-6,85258	0,43647	2,00702	0,39863	0,38323	0,64484	-0,36	6

Source: (IMF 2011); own calculations

5.1.1. CPI % change – use of averages

The averages of the periods may by also used to evaluate the effect of the inflation targeting. This approach is also used for the GDP percentage change since it could better capture the changes over the years than the individual years at the beginning and the end of the period. The use of averages in this section can stand for the check of the previous results. The beginning period for the IT countries are the values from 1990 to the year of IT adoption, X, (inclusive) and for the non-IT the years are 1990 to 2002 (average year of adoption among ITs). The final period begins in X + 1 for ITs and 2003 for non-ITs and end in 2007. Second model also uses the crisis period of 2008-2010 for both groups.

Model 1: OLS, using observations 1-35 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	8,45355	1,31739	6,4169	<0,00001	***
B	-0,999924	0,0016864	-592,9342	<0,00001	***
D	-2,46914	1,40442	-1,7581	0,08829	*

Mean dependent var	-85,58526	S.D. dependent var	220,1498
Sum squared resid	736,2923	S.E. of regression	4,796784
R-squared	0,999553	Adjusted R-squared	0,999525
F(2, 32)	193283,3	P-value(F)	4,86e-66
Log-likelihood	-102,9727	Akaike criterion	211,9455
Schwarz criterion	216,6115	Hannan-Quinn	213,5562

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 6,92535 with p-value = P(Chi-Square(4) > 6,92535) = 0,139886

Model 1 deals with the pre-crisis periods from year 1990 to 2007. It shows that using the averages of the periods, the decrease in CPI was higher for the IT countries. The contribution of the IT regime is visible from the negative value of the dummy coefficient which is also significant on 10% level. According to the model 1, the regime helped to lower the CPI change by approximately -2.5%.

Regarding the crisis period, which is than taken as the final (2008-2010) one, it was used in regression with the beginning period (2002-2007) which already reflects the inflation targeting adoption. The results are delivered by following model 2.

Model 2: OLS, using observations 1-38 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3,45102	1,55093	2,2251	0,03261	**
B	-0,339982	0,266972	-1,2735	0,21124	
D	-1,60386	0,915649	-1,7516	0,08860	*

Mean dependent var	0,271258	S.D. dependent var	4,100909
Sum squared resid	520,7826	S.E. of regression	3,857396
R-squared	0,163060	Adjusted R-squared	0,115235
F(2, 35)	3,446983	P-value(F)	0,043007
Log-likelihood	-103,6568	Akaike criterion	213,3137
Schwarz criterion	218,2265	Hannan-Quinn	215,0616

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 28,3562 with p-value = P(Chi-Square(4) > 28,3562) = 1,05622e-005

The model shows negative values of the dummy coefficient which is significant on the 10% level. However, for the purposes of the maintenance of the inflation levels during the crisis, the positive value would be more plausible as already discussed above. The model also show quite low fit with the data, low value of R^2.

The volatility of the CPI was also assessed on the average values derived from the above described periods. Model 3 derives the pre-crisis values and the model 4 follows with crisis observations regression.

Model 3: OLS, using observations 1-39 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	4,20683	1,04397	4,0297	0,00028	***
B	-1,00081	0,000401489	-2492,7450	<0,00001	***
D	-1,49372	1,05955	-1,4098	0,16719	

Mean dependent var	-179,2042	S.D. dependent var	497,4555
Sum squared resid	447,8123	S.E. of regression	3,526929
R-squared	0,999952	Adjusted R-squared	0,999950
F(2, 36)	5384797	P-value(F)	2,72e-99
Log-likelihood	-102,9344	Akaike criterion	211,8689
Schwarz criterion	216,8596	Hannan-Quinn	213,6595

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 2,12985 with p-value = P(Chi-Square(4) > 2,12985) = 0,711891

Before the crisis, the volatility of the CPI % volume changes was lower for the IT regimes. The contribution of the IT according to the model would be the decrease in volatility by -1.5% the dummy coefficient is not significant on the 10% level. However, the result suggests a bigger decrease in CPI volatility for countries using the IT regime.

Model 4: OLS, using observations 1-39 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	5,28121	0,89421	5,9060	<0,00001	***
B	-1,00845	0,13237	-7,6184	<0,00001	***
D	-2,696	0,891012	-3,0258	0,00456	***

Mean dependent var	0,638973	S.D. dependent var	4,514224
Sum squared resid	299,6946	S.E. of regression	2,885282
R-squared	0,612984	Adjusted R-squared	0,591483
F(2, 36)	31,30522	P-value(F)	1,33e-08

Log-likelihood	-95,10305	Akaike criterion	196,2061
Schwarz criterion	201,1968	Hannan-Quinn	197,9967

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 8,63529 with p-value = P(Chi-Square(4) > 8,63529) = 0,0708909

For the period of the crisis, the change for the ITs should be according to the results of the model 4, bigger than in the pre-crisis period. On the 1% level of significance, the model shows the negative value of dummy coefficient. It means a reduction of -2.7% in CPI% changes in volume for the IT countries. Therefore the volatility in the IT countries should have been lower than in non-IT countries.

5.2. GDP deflator estimations

As another measure of the inflation in the economy the GDP deflator can be used. "The GDP deflator reflects movements of hundreds of separate deflators for the individual expenditure components of GDP. These components include expenditure on such items as "bread, investment in computers, imports of aircraft, and exports of consultancy services" (HM Treasury 2010). The deflator should be the suitable aggregate expression of the inflation (Kadeřábková 2002, 113) and therefore is also assumed in this work. Again data for the beginning and final periods are collected, changes are determined and used in the difference-in-differences regression introduced above.

Following table 14 shows the data for the models 1 and 2 of the GDP deflator estimations.

Table 14: GDP deflator - model 1 and 2 data

Country	Beginning 1980	Final 2005	Change	Final 2007	Change
IT					
Brazil	91,22	7,21	-84,01	5,88	-85,34
Chile	29,26	7,55	-21,70	5,45	-23,80
Colombia	27,61	5,56	-22,05	5,04	-22,58
Guatemala	10,03	5,63	-4,39	7,14	-2,89
Hungary	5,45	2,28	-3,17	5,89	0,44
Indonesia	29,15	14,33	-14,81	11,26	-17,89
Mexico	34,52	4,29	-30,24	5,60	-28,92
Peru	59,95	3,32	-56,63	2,19	-57,76
Philippines	6,56	6,02	-0,54	2,52	-4,04
South Africa	24,92	6,95	-17,97	8,06	-16,86
Thailand	13,13	4,56	-8,57	3,55	-9,58
Uruguay	50,95	5,08	-45,87	9,74	-41,21
Mean	31,89	6,06	**-25,83**	6,03	**-25,87**
Non-IT					
Argentina	165,59	8,84	-156,75	14,25	-151,34
China,P.R.: Mainland	4,10	4,55	0,45	4,78	0,68
Dominican Republic	13,70	2,69	-11,01	5,70	-8,00
Haiti	15,24	17,59	2,35	n.a.	n.a.
India	11,56	4,71	-6,84	5,47	-6,09
Kenya	8,60	6,28	-2,32	n.a.	n.a.
Madagascar	14,99	18,32	3,33	9,61	-5,37
Malawi	16,70	11,27	-5,44	n.a.	n.a.
Mauritius	26,57	4,26	-22,31	8,18	-18,39
Pakistan	10,53	7,03	-3,50	7,65	-2,87
Paraguay	16,92	8,10	-8,81	10,23	-6,69
Venezuela, Rep. Bol.	24,85	29,60	4,76	13,90	-10,95
Mean	27,44	10,27	**-17,17**	8,86	**-23,22**

Source: (IMF 2011); own calculations

Model 1: OLS, using observations 1-24, Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	10,1612	2,53463	4,0089	0,00064	***
B1980	-0,996032	0,0152023	-65,5186	<0,00001	***
D	-4,22317	2,47061	-1,7094	0,10212	

Mean dependent var	-21,50248	S.D. dependent var	35,62514
Sum squared resid	784,2905	S.E. of regression	6,111233
R-squared	0,973132	Adjusted R-squared	0,970573
F(2, 21)	2397,917	P-value(F)	1,64e-25
Log-likelihood	-75,89523	Akaike criterion	157,7905
Schwarz criterion	161,3246	Hannan-Quinn	158,7281

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 6,47882 with p-value = P(Chi-Square(4) > 6,47882) = 0,16613

Model number 1 for the GDP deflator data uses beginning year 1980 and final year 2005. The coefficient of the dummy for the IT regime is of the negative sign, which signals for the advantages of the monetary policy, however, the 10% significance level was exceeded for 0.2%.

Model 2: OLS, using observations 1-21 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	7,73012	1,08329	7,1358	<0,00001	***
B1980	-0,964677	0,0105318	-91,5964	<0,00001	***
D	-2,83082	1,23736	-2,2878	0,03447	**

Mean dependent var	-24,73570	S.D. dependent var	35,81004
Sum squared resid	144,0469	S.E. of regression	2,828888
R-squared	0,994384	Adjusted R-squared	0,993759
F(2, 18)	5236,208	P-value(F)	1,29e-25
Log-likelihood	-50,01668	Akaike criterion	106,0334
Schwarz criterion	109,1669	Hannan-Quinn	106,7134

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 2,94719 with p-value = P(Chi-Square(4) > 2,94719) = 0,566701

In the model 2, final year 2007 is presented and the dummy coefficient is significant, according to the p-value on the 5% level. The IT regime works for the countries which adopted it.

The same procedure is completed in the models 3 and 4 where the beginning year changes to 1990, the final years are 2005 and 2007 respectively. Using another beginning year, the 1990, works as a robustness check for the regression outcomes.

Model 3: OLS, using observations 1-29 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	9,76421	2,03551	4,7969	0,00006	***
B1990	-1,00048	0,000277384	-3606,8276	<0,00001	***
D	-3,16737	2,1732	-1,4575	0,15696	

Mean dependent var	-381,0375	S.D. dependent var	1143,249
Sum squared resid	858,2535	S.E. of regression	5,745411
R-squared	0,999977	Adjusted R-squared	0,999975
F(2, 26)	6546599	P-value(F)	7,47e-75
Log-likelihood	-90,26947	Akaike criterion	186,5389
Schwarz criterion	190,6408	Hannan-Quinn	187,8236

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 2,8984 with p-value = P(Chi-Square(4) > 2,8984) = 0,574969

Model 4: OLS, using observations 1-26 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	8,63085	1,0368	8,3245	<0,00001	***
B1990	-1,00037	0,000540986	-1849,1588	<0,00001	***
D	-2,0063	1,42061	-1,4123	0,17126	

Mean dependent var	-425,4395	S.D. dependent var	1201,599
Sum squared resid	248,1165	S.E. of regression	3,284459
R-squared	0,999993	Adjusted R-squared	0,999993
F(2, 23)	2238933	P-value(F)	1,49e-61
Log-likelihood	-66,21783	Akaike criterion	138,4357
Schwarz criterion	142,2099	Hannan-Quinn	139,5225

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 7,2655 with p-value = P(Chi-Square(4) > 7,2655) = 0,122505

The models 3 and 4 do not present significantly different outcomes while compared to the models 1 and 2. Again, the coefficient is of the negative sign as expected. However, the 10% level of statistical significance of the coefficient of the main variable of the interest, dummy D, is again slightly exceeded. This can be caused by the relatively low number of observations presented. Same regressions are done for the period of the crisis in the models 5 and 6. Data for the models 5 and 6 are presented in the table 15.

Table 15: GDP deflator - model 5 and 6 data

Country	Beginning 2005	Final 2009	Change	Beginning 2007	Change
IT					
Brazil	7,21	4,80	-2,41	5,88	-1,08
Chile	7,55	4,20	-3,35	5,45	-1,25
Colombia	5,56	4,30	-1,26	5,04	-0,74
Guatemala	5,63	2,36	-3,28	7,14	-4,78
Hungary	2,28	4,37	2,09	5,89	-1,52
Indonesia	14,33	8,44	-5,89	11,26	-2,82
Mexico	4,29	3,91	-0,38	5,60	-1,69
Peru	3,32	1,43	-1,89	2,19	-0,76
Philippines	6,02	-0,36	-6,38	2,52	-2,88
Poland	2,64	3,24	0,59	3,96	-0,72
Romania	12,18	2,79	-9,40	13,58	-10,79
South Africa	6,95	7,16	0,21	8,06	-0,90
Thailand	4,56	2,02	-2,54	3,55	-1,53
Turkey	7,08	5,15	-1,93	6,22	-1,07
Uruguay	5,08	5,85	0,78	9,74	-3,89
Mean	6,31	3,98	**-2,34**	6,40	**-2,43**
Non-IT					
Argentina	8,84	9,62	0,78	14,25	-4,63
Bulgaria	7,50	4,14	-3,36	9,47	-5,33
China,P.R.: Mainland	4,55	0,41	-4,14	4,78	-4,36
China,P.R.:Macao	4,86	-3,70	-8,55	4,85	-8,55
Dominican Republic	2,69	2,95	0,26	5,70	-2,75
India	4,71	4,46	-0,25	5,47	-1,01
Latvia	10,17	-1,50	-11,67	20,29	-21,79
Lithuania	6,61	-3,71	-10,32	8,50	-12,21
Madagascar	18,32	8,55	-9,77	9,61	-1,06
Mauritius	4,26	2,68	-1,58	8,18	-5,50
Nicaragua	9,87	4,86	-5,00	9,04	-4,17
Pakistan	7,03	20,01	12,99	7,65	12,36
Paraguay	8,10	-0,12	-8,22	10,23	-10,35
Vietnam	8,19	6,03	-2,16	8,24	-2,21
Mean	7,55	3,91	**-3,64**	9,02	**-5,11**

Source: (IMF 2011); own calculations

Model 5: OLS, using observations 1-29 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	1,11442	2,02201	0,5511	0,58624	
B2005	-0,630081	0,121754	-5,1750	0,00002	***
D	0,526707	1,74909	0,3011	0,76571	

Mean dependent var	-2,966994	S.D. dependent var	4,877132
Sum squared resid	518,2505	S.E. of regression	4,464606
R-squared	0,221869	Adjusted R-squared	0,162013
F(2, 26)	15,67227	P-value(F)	0,000034
Log-likelihood	-82,95508	Akaike criterion	171,9102
Schwarz criterion	176,0120	Hannan-Quinn	173,1948

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 3,68787 with p-value = P(Chi-Square(4) > 3,68787) = 0,449893

Model 5 with the data from the years 2005 and 2009 does not show significance for the dummy coefficient and even the fit of the data is according to the low R^2 limited. However, the dummy is of a positive sign as expected for the crisis period. Similar outcome is shown in the model 6 for years 2007 and 2009. Again the significance of the dummy is not present to support the evidence that the IT regime had been important for the countries in terms of maintaining low, but still positive, and stable inflation during the crisis using the GDP deflator data.

Model 6: OLS, using observations 1-29 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	2,57649	3,03382	0,8493	0,40349	
B2007	-0,852437	0,286687	-2,9734	0,00628	***
D	0,454666	1,90963	0,2381	0,81368	

Mean dependent var	-3,723756	S.D. dependent var	5,575488
Sum squared resid	557,0972	S.E. of regression	4,628911
R-squared	0,359960	Adjusted R-squared	0,310726
F(2, 26)	5,497036	P-value(F)	0,010208
Log-likelihood	-84,00315	Akaike criterion	174,0063
Schwarz criterion	178,1082	Hannan-Quinn	175,2910

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 3,11544 with p-value = P(Chi-Square(4) > 3,11544) = 0,538697

The differences in the means of the GDP deflator falls behave in the similar way as the results of the regression suggest. For the pre-crisis period the change for the IT countries is more significant and this fact was also supported by the outcomes of the model 1 and 2. The usefulness of the IT regime for the period crisis was not highlighted by the models 5 and 6 in terms of the dummy significance but they showed the expected positive values. Data in the table 16 also show small difference between the falls in GDP deflator during this time framework, especially for the change 2009-2005. The GDP deflator measurements are summarized in the table 16.

Table 16: GDP deflator - outcomes of the models

model	**constant**	p-value	**dummy D**	p-value	**begin. B**	p-value	$\mathbf{R^2}$	observ.
1 (1980 - 2005)	10,1612	0,00064	-4,22317	0,10212	-0,99603	<0,00001	0,97	24
2 (1980 - 2007)	7,73012	<0,00001	-2,83082	0,03447	-0,96468	<0,00001	0,99	21
3 (1990 - 2005)	9,7642	0,00006	-3,16737	0,15696	-1,00048	<0,00001	0,99	29
4 (1990 - 2007)	8,63085	<0,00001	-2,0063	0,17126	-1,00037	<0,00001	0,99	26
5 (2005 - 2009)	1,11442	0,58624	0,526707	0,76571	-0,63008	0,00002	0,16	29
6 (2007 - 2009)	2,57649	0,40349	0,454666	0,81368	-0,85244	0,00628	0,31	29

Source: (IMF 2011); own calculations

5.3. GDP percentage change in volume estimations

Possible effects of the inflation targeting are also analysed in terms of the GDP. Using the GDP percentage change data from the IMF statistics again the difference-in-difference regressions are run in this section to evaluate the behaviour of the data.

Models 1 and 2 use data starting in 1980, to enlarge the range of the time assessed. However, the year 1980 lacks few observations for the selected countries and therefore is the sample smaller than in later models. Table 17 shows the data for models 1 and 2.

Table 17: GDP % change in volume - model 1 and 2 data

Country	Beginning 1980	Final 2005	Change	Final 2007	Change
IT					
Hungary	0,21	3,17	2,95	0,77	0,56
Turkey	-2,44	8,40	10,85	4,67	7,11
Philippines	5,15	5,40	0,25	7,53	2,38
Thailand	4,78	4,46	-0,32	4,93	0,15
Brazil	9,23	3,16	-6,07	6,08	-3,15
Chile	7,73	5,56	-2,17	4,60	-3,13
Guatemala	3,74	3,26	-0,48	6,30	2,56
Mexico	8,32	3,28	-5,05	3,36	-4,96
Peru	7,66	6,45	-1,21	8,69	1,03
Uruguay	6,00	6,62	0,62	7,46	1,46
South Africa	6,62	5,28	-1,34	5,57	-1,05
Indonesia	9,88	5,69	-4,19	6,35	-3,54
Mean	5,57	5,06	**-0,51**	5,53	**-0,05**
Non-IT					
Honduras	0,69	6,05	5,36	6,31	5,61
China,P.R.: Mainland	7,81	11,31	3,50	14,16	6,36
India	6,62	9,49	2,87	9,22	2,61
Malaysia	7,44	5,33	-2,11	6,48	-0,96
Pakistan	8,70	7,67	-1,03	5,68	-3,02
Argentina	1,45	9,18	7,72	8,66	7,20
Bolivia	0,57	4,42	3,86	4,56	4,00
Dominican Republic	6,05	9,26	3,21	8,47	2,42
Haiti	7,22	1,79	-5,42	n.a.	
Paraguay	11,71	2,86	-8,85	6,76	-4,95
Venezuela, Rep. Bol.	-1,99	10,32	12,31	8,40	10,39
Malawi	-0,38	2,57	2,95	5,76	6,14
Madagascar	0,81	4,59	3,79	6,24	5,44
Mauritius	-10,06	1,24	11,30	5,52	15,58
Kenya	3,97	5,72	1,75	n.a.	
Mean	3,37	6,12	**2,75**	7,40	**4,37**

Source: (IMF 2011); own calculations

The data presented in the table 17 suggest that the changes in GDP volume were smaller and even of negative sign for the IT countries in both models. On the other hand, the non-IT countries performed bigger percentage changes in GDP volume in both periods. The IT countries begun with higher GDP % change values in 1980 than non-ITs but the values for 2007 show that the ITs remain almost at the same level but the non-ITs increased the values for approximately 4%. This might be the fact that the IT countries sample performed slower growth than the non-IT in these periods. However, the values of separate years may not be appropriate for this case since they could reflect certain extremes or different position in the business cycle of the particular country. Therefore the analysis of average values of two periods follows after the models of this part.

Model 1: OLS, using observations 1-27 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	5,84762	0,988949	5,9130	<0,00001	***
Beginning_1980	-0,919258	0,154339	-5,9561	<0,00001	***
D	-1,23699	1,08356	-1,1416	0,26488	

Mean dependent var	1,297648	S.D. dependent var	5,270143
Sum squared resid	175,9828	S.E. of regression	2,707880
R-squared	0,756302	Adjusted R-squared	0,735994
F(2, 24)	26,01207	P-value(F)	9,80e-07
Log-likelihood	-63,61775	Akaike criterion	133,2355
Schwarz criterion	137,1230	Hannan-Quinn	134,3915

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 9,86636 with p-value = P(Chi-Square(4) > 9,86636) = 0,04274

Model 1 includes 27 observations, the beginning year is 1980 and the final is 2005. The dummy for the inflation targeting is not significant and the heteroskedasticity might be present. The imperfections could be the result of small number of observations. It should be also stated that the sample starting at 1980 might not be strong enough since the average year of the IT adoption for the selected EMEs is 2002. Therefore the 3 years of observations might not be enough to reflect the changes caused by the IT regime.

Model 2, with the same starting year but final year 2007, on the other hand show significance of the dummy of the interest, although it lacks additional 2 observations. This would mean that the IT presence lowers the GDP percentage change by 2.3%.

Model 2: OLS, using observations 1-25 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	6,88255	0,547289	12,5757	<0,00001	***
Beginning_1980	-0,828346	0,0908804	-9,1147	<0,00001	***
D	-2,3128	1,01847	-2,2708	0,03329	**

Mean dependent var	2,250021	S.D. dependent var	5,011085
Sum squared resid	106,3186	S.E. of regression	2,198332
R-squared	0,823585	Adjusted R-squared	0,807548
F(2, 22)	114,0815	P-value(F)	2,43e-12
Log-likelihood	-53,56802	Akaike criterion	113,1360
Schwarz criterion	116,7927	Hannan-Quinn	114,1502

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 3,08434 with p-value = P(Chi-Square(4) > 3,08434) = 0,543811

Models 3 and 4 have the beginning year 1990 and final year 2005 and 2007 respectively. The model 3 is not presented here since it again did not deliver significant values for the dummy and therefore the effect of the IT would be difficult to evaluate. The results of the model 3 are included in the table 19 together with the results of other models of this section. The non-significance here might be present due to the facts that are discussed below, the different speed of convergence.

Model 4: OLS, using observations 1-31 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	8,36555	1,03321	8,0967	<0,00001	***
Beginning_1990	-0,938967	0,122248	-7,6809	<0,00001	***
D	-2,47346	1,2714	-1,9455	0,06182	*

Mean dependent var	5,117694	S.D. dependent var	6,400852
Sum squared resid	466,5039	S.E. of regression	4,081771
R-squared	0,620459	Adjusted R-squared	0,593349
F(2, 28)	80,26626	P-value(F)	2,54e-12
Log-likelihood	-86,01192	Akaike criterion	178,0238
Schwarz criterion	182,3258	Hannan-Quinn	179,4262

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 4,16708 with p-value = P(Chi-Square(4) > 4,16708) = 0,383866

Following table 18 presents the data for the models 5 and 6 which did not deliver significant values of the IT dummy coefficient either. As already stated, the models did not suggest the IT effect in this case.

Table 18: GDP % change in volume - model 5 and 6 data

Country	Beginning 2005	Final 2009	Change	Beginning 2007	Change
IT					
Hungary	3,17	-6,69	-9,86	0,77	-7,47
Poland	3,62	2,05	-1,57	6,79	-4,74
Romania	4,12	-7,13	-11,26	6,27	-13,40
Turkey	8,40	-4,69	-13,09	4,67	-9,36
Philippines	5,40	4,01	-1,39	7,53	-3,52
Thailand	4,46	-2,25	-6,71	4,93	-7,18
Brazil	3,16	-0,19	-3,35	6,08	-6,27
Chile	5,56	-1,53	-7,09	4,60	-6,13
Guatemala	3,26	0,57	-2,69	6,30	-5,73
Mexico	3,28	-6,01	-9,28	3,36	-9,37
Peru	6,45	0,88	-5,57	8,69	-7,82
Uruguay	6,62	2,86	-3,77	7,46	-4,60
South Africa	5,28	-1,68	-6,96	5,57	-7,25
Indonesia	5,69	4,55	-1,15	6,35	-1,80
Mean	4,89	-1,09	**-5,98**	5,67	**-6,76**
Non-IT					
Bulgaria	6,25	-5,03	-11,27	6,17	-11,19
Latvia	10,60	-17,96	-28,56	9,98	-27,93
Lithuania	7,80	-14,74	-22,54	9,84	-24,58
Honduras	6,05	-2,07	-8,12	6,31	-8,38
China,P.R.: Mainland	11,31	9,11	-2,20	14,16	-5,05
China,P.R.:Macao	6,92	1,33	-5,59	25,99	-24,66
India	9,49	7,44	-2,05	9,22	-1,79
Malaysia	5,33	-1,71	-7,05	6,48	-8,19
Pakistan	7,67	3,63	-4,04	5,68	-2,05
Vietnam	8,44	5,32	-3,12	8,46	-3,13
Argentina	9,18	0,65	-8,53	8,66	-8,01
Dominican Republic	9,26	3,45	-5,81	8,47	-5,02
Nicaragua	4,28	-1,45	-5,73	3,08	-4,53
Paraguay	2,86	-3,84	-6,70	6,76	-10,61
Malawi	2,57	7,54	4,97	5,76	1,78
Madagascar	4,59	-4,57	-9,16	6,24	-10,81
Mauritius	1,24	1,67	0,43	5,52	-3,85
Mean	6,70	-0,66	**-7,36**	8,63	**-9,29**

Source: (IMF 2011); own calculations

No evidence is delivered for the effects of the IT during the crisis period. In the model 5 with the beginning year 2005 and final year 2009 the fit of the data, according to the R^2, was very low. Model 5 is therefore introduced only as a summary in table 20. Dummy coefficient in the model 6 (beginning = 2007 and final = 2009) was positive, but very low and again insignificant with possible presence of the heteroskedasticity.

Model 6: OLS, using observations 1-31 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-2,78352	1,97686	-1,4080	0,17012	
Beginning_2007	-0,754063	0,181255	-4,1602	0,00027	***
D	0,299587	1,96422	0,1525	0,87987	

Mean dependent var	-8,149435	S.D. dependent var	6,686643
Sum squared resid	1025,514	S.E. of regression	6,051900
R-squared	0,235453	Adjusted R-squared	0,180843
F(2, 28)	8,653790	P-value(F)	0,001185
Log-likelihood	-98,22100	Akaike criterion	202,4420
Schwarz criterion	206,7440	Hannan-Quinn	203,8443

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 10,1467 with p-value = P(Chi-Square(4) > 10,1467) = 0,038028

All models from this section are summarized in the table 19.

Table 19: Summary of the models for GDP % change data

model	**constant**	p-value	**dummy D**	p-value	**begin. B**	p-value	$\mathbf{R^2}$	obs.
1 (1980-2005)	5,8476	<0,00001	-1,2370	0,26488	-0,9193	<0,00001	0,74	27
2 (1980-2007)	6,8826	<0,00001	-2,3128	0,03329	-0,8283	<0,00001	0,81	25
3 (1990-2005)	6,2483	<0,00001	-0,8219	0,41784	-0,9825	<0,00001	0,75	33
4 (1990-2007)	8,3656	<0,00001	-2,4735	0,06182	-0,9390	<0,00001	0,59	31
5 (2005-2009)	-1,1305	0,73740	-0,3027	0,86659	-0,9297	0,13908	0,07	31
6 (2007-2009)	-2,7835	0,17012	0,2996	0,87987	-0,7541	0,00027	0,18	31

Source: (IMF 2011); own calculations

5.3.1. GDP % change – use of averages

Against the expectations that the IT would not influence GDP in terms of lower growth[15], these values for different years show negative effect on GDP percentage change in volume. However, changes in GDP volume are influenced by many factors e.g. different position in the business cycle at the time of measurements, characteristics different from the monetary policy used, speed of convergence of particular countries etc. To ensure that the individual years used do not stay for extremes of values achieved, e.g. because of the mentioned position in the business cycle etc. the averages of the periods pre- and after-adoption of IT are presented in this section. These averages were used to run the regressions for GDP percentage change. To capture the effect of the IT, the periods for the targeters and non-targeters were chosen in the following way. Beginning period starts in the year 1990 for

[15] "Economic theory and evidence both support the idea that low and stable inflation promotes economic growth and efficiency...inflation targeting can help an environment in which the economy can prosper" (Bernanke a et.al 1999, 297-298).

both groups and ends in the year X, X is the year of adoption of the framework, for the IT countries and in the year 2002, since this is the average year of adoption of the regime, for non-IT countries. Final period starts in the year X + 1 for ITs and 2003 for the non-ITs and it ends in the year 2007, so the influence of the crisis is minimised. The model for these periods follows.

Model 1: OLS, using observations 1-36 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	5,99172	0,957776	6,2559	<0,00001	***
B	-0,709086	0,191386	-3,7050	0,00077	***
D	-2,10108	0,881911	-2,3824	0,02312	**

Mean dependent var	2,993298	S.D. dependent var	3,514759
Sum squared resid	278,5417	S.E. of regression	2,905281
R-squared	0,355785	Adjusted R-squared	0,316741
F(2, 33)	10,74677	P-value(F)	0,000255
Log-likelihood	-87,91067	Akaike criterion	181,8213
Schwarz criterion	186,5719	Hannan-Quinn	183,4794

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 2,28189 with p-value = P(Chi-Square(4) > 2,28189) = 0,684069

The model for the averages shows results of negative values of dummy variable significant on the 5 percent level. This would mean relatively high costs of inflation reduction among the IT countries in terms of the lower GDP percentage volume changes (-2.1%), decrease in the growth speed. However, the variety of issues which might have contributed to this evolution of the GDP changes in the IT EMEs and their non-IT counterparts could be present and therefore influence the outcomes of the regressions. For example in the section 3.2.4, the GDP p.c. USD data present the development over the period 1980 to 2007 and the positive change for the IT countries was 4,201.23 USD while the non-ITs performed change of 2,183.59 USD. The countries begun with approximately same values of GDP p.c. USD in 1980, therefore the faster convergence of the IT countries to the advanced economies is present. These issues may be the explanation of lower GDP changes in volume as the regressions suggest, since the IT countries could have already reach the higher convergence state and therefore later on grow on the lower level than the non-ITs, so the GDP percentage changes would be lower. This would be a state of the beta convergence, which "occurs when less developed economies (with lower GDP per capita) tend to grow faster than more developed ones (with higher GDP per capita)" (Rapacki a

Prochniak 2009). Assuming the mean values of the GDP % change, the observations from 1990 to 2010 showed average values of 0.72% for the IT countries and 1.92% for the non-IT countries. Respective tables are included in the Annex 6.

To assess the volatility of the GDP, the regression is also run for the standard deviations of the variable using similar system of averages of periods shown above. This time the beginning period is 1990-2001 for both groups of countries and the final period is 2001-2007 again for the both groups. Resulting model follows.

Model (Standard deviation of GDP % change averages): OLS, using observations 1-36
Dependent variable: Change Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3,24643	0,776089	4,1831	0,00020	***
B	-0,972293	0,111978	-8,6829	<0,00001	***
D	-1,20907	0,746179	-1,6203	0,11468	

Mean dependent var	-1,401685	S.D. dependent var	3,398563
Sum squared resid	193,6797	S.E. of regression	2,422619
R-squared	0,520901	Adjusted R-squared	0,491864
F(2, 33)	39,53895	P-value(F)	1,73e-09
Log-likelihood	-81,37015	Akaike criterion	168,7403
Schwarz criterion	173,4909	Hannan-Quinn	170,3984

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 6,14201 with p-value = P(Chi-Square(4) > 6,14201) = 0,188791

The model implies that there was the reduction in the volatility of the variable by -1.2% although not significant on the 10% level. However, the result of lower volatility is in line with the findings from the previous sections that the IT regime performed lower volatility of GDP in both periods 1980-2009 and 2002-2009 then the respective non-IT countries. The volatility changed in following ways for individual countries.

Figure 13: IT countries, std. dev. GDP % change in volume, B(1990-2001), F(2001-2007)

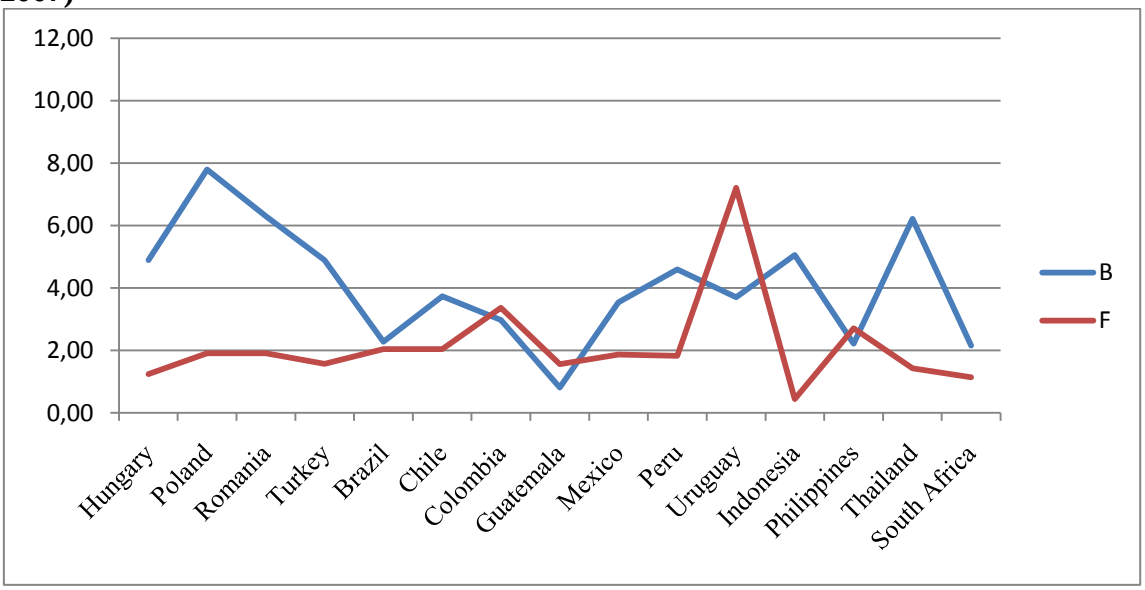
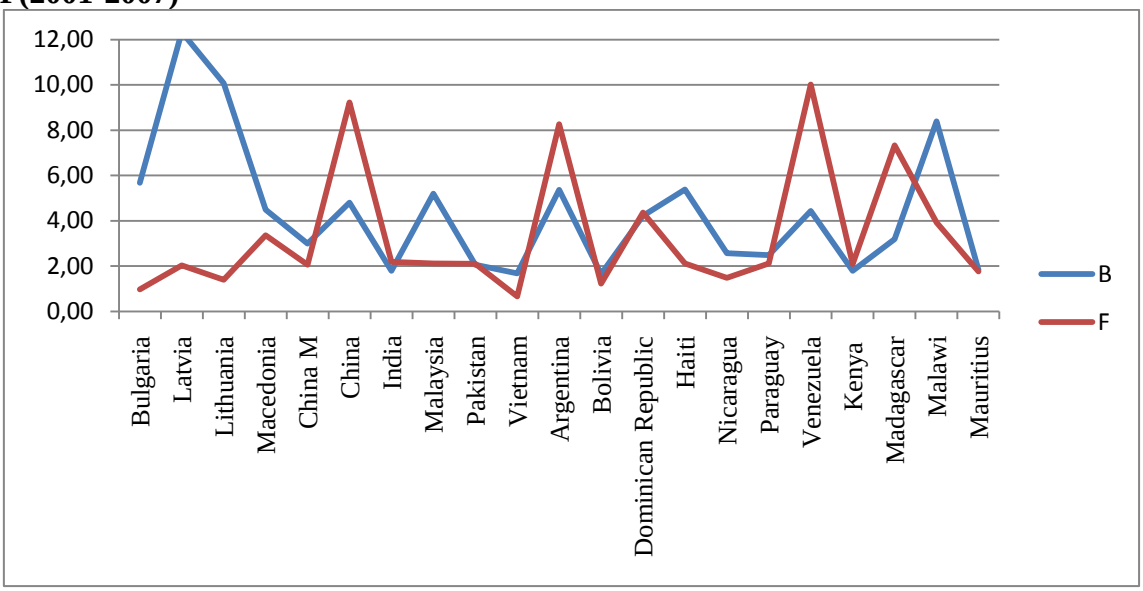


Figure 14: non-IT countries, std. dev. GDP % change in volume, B(1990-2001), F(2001-2007)



The figures 13 and 14 depict the performance of the individual countries in terms of GDP volatility. The IT countries lowered the average volatility after the IT adoption. However, some countries have not improved in terms of lower standard deviation the extreme case here is Uruguay. Also Colombia and Guatemala showed lower values in the period prior the adoption. Regarding the non-IT countries, the differences between the periods are very small. The average standard deviation change was -0.91% for ITs and -0.22% for non-ITs. This would again support the outcomes of the model presented above.

The values for the crisis were different since the volatility increased for both groups. However, the non-ITs performed an increase of 4.55% in terms of standard deviation and ITs performed increase of 3.82%. This shows the lower volatility of GDP in the crisis period for the ITs and could be a cause of the IT regime effect.

5.4. GDP per capita (current U.S. dollars) estimations

With the intention to compare the different monetary policy regimes, the GDP p.c. USD was also used for the estimations. However, it should be seen as another possibility to check previous results and the weight given to these observations should be lower than to other section outcomes. This is due to the possible complications which might occur from the changes of the exchange rate between national currency and USD.

Using the World Bank data on the GDP per capita denoted in current U.S. dollars the regressions are run for the same years as were run in the section 3.2.3 for the GDP percentage volume change. Following table 20 shows data for the model 1 and 2.

Table 20: GDP per capita (USD) – model 1 and 2

Country	Beginning 1980	Final 2005	Change	Final 2007	Change
IT					
Brazil	1932,48	4741,03	2808,55	7184,84	5252,37
Chile	2465,92	7255,69	4789,78	9877,01	7411,09
Colombia	1242,09	3405,61	2163,52	4674,60	3432,51
Ghana	403,15	489,17	86,02	1077,02	673,87
Guatemala	1123,01	2140,99	1017,98	2554,57	1431,56
Hungary	2069,90	10924,45	8854,55	13798,75	11728,85
Indonesia	532,22	1304,08	771,87	1923,29	1391,08
Mexico	2876,38	8235,08	5358,70	9741,43	6865,05
Peru	1192,33	2851,89	1659,57	3770,54	2578,21
Philippines	674,48	1155,89	481,41	1623,91	949,43
South Africa	2926,83	5234,58	2307,75	5932,82	3006,00
Thailand	684,53	2674,20	1989,67	3689,37	3004,84
Turkey	1490,19	6786,38	5296,18	8864,69	7374,49
Uruguay	3488,12	5252,37	1764,25	7205,96	3717,84
Mean	1650,12	4460,82	**2810,70**	5851,34	**4201,23**
Non-IT					
Argentina	2733,62	4729,82	1996,19	6603,85	3870,23
Kenya	446,78	523,16	76,38	719,55	272,77
Madagascar	469,77	286,05	-183,72	394,68	-75,10
Malawi	199,15	201,80	2,65	239,51	40,36
Nigeria	861,50	796,78	-64,73	1123,20	261,69
Uganda	98,35	313,60	215,25	388,16	289,82
Zambia	672,64	609,69	-62,95	926,60	253,96

Dominican Rep.	1118,81	3566,82	2448,01	4209,90	3091,10
India	267,41	761,97	494,56	1104,59	837,18
Pakistan	286,35	703,59	417,24	880,56	594,21
Bahrain	8855,12	18500,16	9645,04	24320,79	15465,67
Bolivia	847,18	1039,98	192,80	1377,51	530,34
Bulgaria	2261,30	3733,21	1471,92	5498,04	3236,74
China	193,02	1731,13	1538,10	2651,26	2458,24
Ecuador	1494,25	2846,85	1352,60	3432,02	1937,77
Mauritius	1176,55	5054,36	3877,81	5965,96	4789,41
Nicaragua	659,69	893,26	233,58	1004,13	344,44
Venezuela, RB,	4448,62	5481,30	1032,68	8252,05	3803,43
Zimbabwe	917,13	447,56	-469,57	403,10	-514,04
Mean	1474,06	2748,48	**1274,41**	3657,65	**2183,59**

Source: (The World Bank 2011)

Data in the table 20 express that the mean values of the variable were very similar in the beginning year. However, between the 1980 and 2005, the IT countries performed positive average change of 2810.7 USD per capita while the non-ITs performed for the same period the average change of only 1274.4 USD per capita. However, this can imply possible deppreciation of the ER to USD. Therefore might be better to express the changes in terms of percentage points. The IT showed in the first period (1980-2007) increase by approximately 254% and the respective non-ITs showed 148% increase in GDP p.c. USD. Using the 2007 as a final year, the difference between IT and non-IT is even more significant.

Model 1: OLS, using observations 1-33 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-142,806	299,581	-0,4767	0,63704	
Beginning_1980	0,961436	0,17436	5,5141	<0,00001	***
D	1367,02	651,58	2,0980	0,04443	**

Mean dependent var	1926,171	S.D. dependent var	2446,695
Sum squared resid	88398156	S.E. of regression	1716,568
R-squared	0,538540	Adjusted R-squared	0,507776
F(2, 30)	17,69290	P-value(F)	8,41e-06
Log-likelihood	-291,0391	Akaike criterion	588,0781
Schwarz criterion	592,5677	Hannan-Quinn	589,5887

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 5,04616 with p-value = P(Chi-Square(4) > 5,04616) = 0,282594

Model 1 (beginning year 1980, final year 2005) depicts the positive value of the variable of the interest, the dummy variable, and the result is significant on the 5% level.

Model 2: OLS, using observations 1-33 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-164,545	370,406	-0,4442	0,66006	
Beginning_1980	1,59297	0,200642	7,9393	<0,00001	***
D	1737,19	802,092	2,1658	0,03840	**

Mean dependent var	3039,557	S.D. dependent var	3516,828
Sum squared resid	1,32e+08	S.E. of regression	2097,507
R-squared	0,666515	Adjusted R-squared	0,644283
F(2, 30)	32,65705	P-value(F)	2,95e-08
Log-likelihood	-297,6530	Akaike criterion	601,3060
Schwarz criterion	605,7956	Hannan-Quinn	602,8166

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 5,80097 with p-value = P(Chi-Square(4) > 5,80097) = 0,214514

Using the final year 2007 data (beginning year remaining 1980), the model 2 delivers results similar to the model 1. The coefficient for the dummy is higher in this case.

Regarding the pre-crisis and crisis period (again, the year 2005 is used hear as a benchmark to Goncalves and Salves paper that ends by the year 2005 and concludes that the IT helped to the countries to perform better) following table 21 shows the data of the models 3 and 4. Using the beginning year 2005 and final year 2009, the IT countries had higher GDP p.c. in both years and although both groups of countries rise in terms of GDP p.c., the percentage change for the crisis period was 2.2% for ITs and 15.89% for non-ITs. Therefore the results again might reflect the depreciation of the ER to USD rather than changes in real output. The data for model 4 (beginning 2007, final 2009) also show higher values of the variable for the IT countries in both years, however, the change was bigger for the non-IT countries.

Table 21: GDP per capita (USD) – model 3 and 4

Country	Beginning 2005	Final 2009	Change	Beginning 2007	Change
IT					
Brazil	4741,03	8230,31	3489,28	7184,84	1045,47
Chile	7255,69	9644,46	2388,77	9877,01	-232,55
Colombia	3405,61	5125,86	1720,25	4674,60	451,26
Ghana	489,17	1097,83	608,66	1077,02	20,81
Guatemala	2140,99	2660,73	519,74	2554,57	106,16
Hungary	10924,45	12867,72	1943,27	13798,75	-931,03
Indonesia	1304,08	2349,38	1045,29	1923,29	426,08
Mexico	8235,08	8142,97	-92,11	9741,43	-

					1598,46
Peru	2851,89	4468,55	1616,66	3770,54	698,01
Philippines	1155,89	1752,45	596,56	1623,91	128,54
South Africa	5234,58	5785,99	551,41	5932,82	-146,83
Thailand	2674,20	3892,51	1218,31	3689,37	203,14
Turkey	6786,38	8214,89	1428,52	8864,69	-649,79
Uruguay	5252,37	9420,48	4168,11	7205,96	2214,52
Mean	4460,82	5975,30	**1514,48**	5851,34	**123,95**
Non-IT					
Argentina	4729,82	7626,19	2896,37	6603,85	1022,34
Kenya	523,16	738,05	214,89	719,55	18,50
Madagascar	286,05	437,68	151,63	394,68	43,01
Malawi	201,80	309,73	107,93	239,51	70,22
Nigeria	796,78	1118,11	321,33	1123,20	-5,09
Uganda	313,60	490,46	176,86	388,16	102,30
Zambia	609,69	989,92	380,23	926,60	63,33
Dominican Rep.	3566,82	4637,02	1070,21	4209,90	427,12
India	761,97	1192,08	430,11	1104,59	87,49
Pakistan	703,59	954,52	250,93	880,56	73,96
Bahrain	18500,16	26020,98	7520,82	24320,79	1700,19
Bolivia	1039,98	1758,11	718,13	1377,51	380,60
Bulgaria	3733,21	6423,35	2690,14	5498,04	925,32
China	1731,13	3744,36	2013,23	2651,26	1093,10
Ecuador	2846,85	4201,76	1354,91	3432,02	769,74
Mauritius	5054,36	6734,55	1680,19	5965,96	768,59
Nicaragua	893,26	1069,09	175,83	1004,13	64,96
Venezuela, RB,	5481,30	11490,03	6008,73	8252,05	3237,98
Zimbabwe	447,56	449,18	1,62	403,10	46,09
Mean	2748,48	4230,80	**1482,32**	3657,65	**573,14**

Source: (The World Bank 2011)

Model 3: OLS, using observations 1-33 Dependent variable: Change

Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	532,207	225,704	2,3580	0,02509	**
Beginning_2005	0,345687	0,0522632	6,6143	<0,00001	***
D	-559,773	430,721	-1,2996	0,20363	

Mean dependent var	1495,964	S.D. dependent var	1731,909
Sum squared resid	43564543	S.E. of regression	1205,052
R-squared	0,546128	Adjusted R-squared	0,515870
F(2, 30)	23,06492	P-value(F)	8,58e-07
Log-likelihood	-279,3635	Akaike criterion	564,7271
Schwarz criterion	569,2166	Hannan-Quinn	566,2377

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 9,3009 with p-value = P(Chi-Square(4) > 9,3009) = 0,054003

Model 4: OLS, using observations 1-33 Dependent variable: Change
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	397,671	142,941	2,7821	0,00925	***
Beginning_2007	0,0479741	0,026815	1,7891	0,08370	*
D	-554,43	299,211	-1,8530	0,07375	*

Mean dependent var	382,5778	S.D. dependent var	866,9577
Sum squared resid	20713001	S.E. of regression	830,9232
R-squared	0,138814	Adjusted R-squared	0,081401
F(2, 30)	3,598901	P-value(F)	0,039725
Log-likelihood	-267,0961	Akaike criterion	540,1922
Schwarz criterion	544,6817	Hannan-Quinn	541,7028

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present
Test statistic: LM = 9,86365 with p-value = P(Chi-Square(4) > 9,86365) = 0,0427882

The negative dummy coefficient in the models 3 and 4 shows the negative values of dummy coefficient. This might be caused by the changes in the ER as well as by the convergence issue discussed in the previous section. The results are significant for the model 4 however, in both models the null hypothesis of homoscedasticity is rejected, therefore the outcomes might not be fully reliable.

6. Other indicators of economic stability

6.1. National interest rate – central bank discount rate

The maintenance of the inflation targeting monetary policy is done mainly through the moves in the interest rate, changes in the main policy rate of the central bank. The movements of the interest rate influence the evolution of the economy through the availability of the credit to the economic agents, while performing so called loosening. Or it can act reversely through the unavailability of the credit, the tightening of the interest rates (de Carvalho Filho 2010, 6) Following estimations and calculations were done using the data from the IMF IFS for national interest rates – central bank discount rates comparing the selected countries. The discount rates maintained by the bank through the years 2001 to 2010 are summarized in the table 22.

Table 22: National interest rates – CB discount rates, summary statistics

	Mean	Median	Minimum	Maximum	Std. Dev.
Central and Eastern Europe					
IT					
Albania	6,22	5,75	5	10,75	1,24
Hungary	8,42	8,25	5,25	12,5	2
Poland	6,2	5,25	3,5	19	3,5
Serbia	13,78	13,41	8	30,3	4,21
Turkey	34,58	27	14	60	15,51
Non-IT					
Bulgaria	3	2,82	0,17	5,77	1,44
Latvia	4,16	4	3	6	1,02
Lithuania	3,35	3	1,75	5,25	1,25
Macedonia	7,31	6,5	5	10,7	1,68
Developing Asia					
IT					
Indonesia	10,34	9,01	6,2	17,67	3,38
Philippines	5,36	5,05	3,08	11,93	1,8
Thailand	3,54	3,5	1,75	6,5	1,27
Non-IT					
China_M	3,11	3,24	2,7	4,14	0,42
India	6,16	6	6	8	0,35
Pakistan	10,24	9,5	7,5	15	2,35
Vietnam	6,32	5	4,8	15	2,25
Latin America and Caribbean					
IT					
Brazil	21,71	20,94	15,17	33,9	4,7
Chile	3,97	3,65	0,48	10,16	2,29
Colombia	10,69	11,25	5	18,5	2,99
Peru	4,86	4,25	2,05	14	2,25
Uruguay	49,64	20	7	328,09	69,67
Non-IT					
Paraguay	20	20	20	20	0
Venezuela	31,53	29,5	28,5	50	4,51
Sub-Saharan Africa					
IT					
Ghana	19,41	18,5	12,5	27,5	5,07
South_Africa	9,3	9	5,5	13,5	2,28
Non-IT					
Malawi	28,86	25	15	75,33	13,79
Gambia	15,27	11	9	29	7,26
Nigeria	12,88	13	6	20,5	4,32
Euro area and United States of America					
Euro_area	3,61	3,5	1,75	5,75	1,19
United_States	2,87	2,25	0,5	6,25	1,96

Source: (IMF 2011); own calculations

The data in the table 22 are monthly observations from 2001:01 to 2010:12. The volatility of the rate can serve as an indicator for the authority´s need to use their key policy instrument. Estimating the above listed inflation targeting countries, the volatility of the

central banks´ interest rate is higher than for the non-targeting economies. However, if the countries with the extreme values of the interest rate changes are eliminated (specifically Uruguay and Turkey) the data show slightly lower volatility in targeting economies than among the non-IT countries. Adding the observations for the advanced economies, the averages of standard deviations of the discount rate are summarized in the table 23.

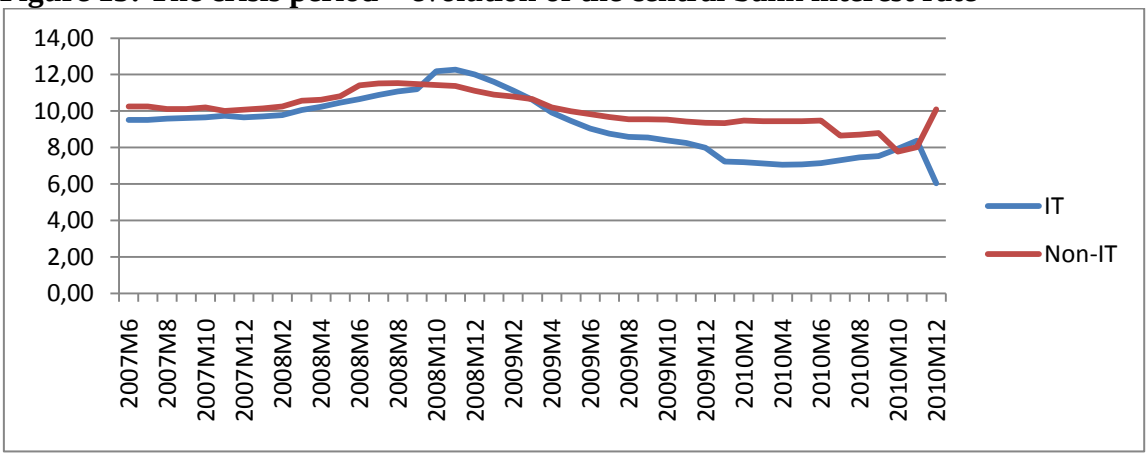
Table 23: Volatility of the CB interest rate (national rates IFS IMF) 2001:01-2010:12[16]

Standard deviation - mean, % p.a.	
IT	2,84
Non-IT	3,12
Euro area and the U.S.	1,58

Source: (IMF 2011); own calculations

As might have been expected, according to their higher overall economic development and historical experience with the maintaining stable economy indicators, the Euro area and U.S. together show lower levels of interest rate volatility. Regarding the time period of the crisis, the moves of the interest rate levels were as follows.

Figure 15: The crisis period – evolution of the central bank interest rate



Source: (IMF 2011); own calculations

The inflation targeting countries followed similar path as the non-targeting economies (figure 15). The answers to the shocks derived from the actions of the global economy are one of the factors supporting the similarities in the path of the interest rate. With the upcoming crisis, the interest rates for both groups increased and were at their peak in the middle of the 2008 for non-ITs and in November 2008 for ITs. This was the period of high commodity prices as explained in the section 4.1.1 (page 30). From the peak until the end

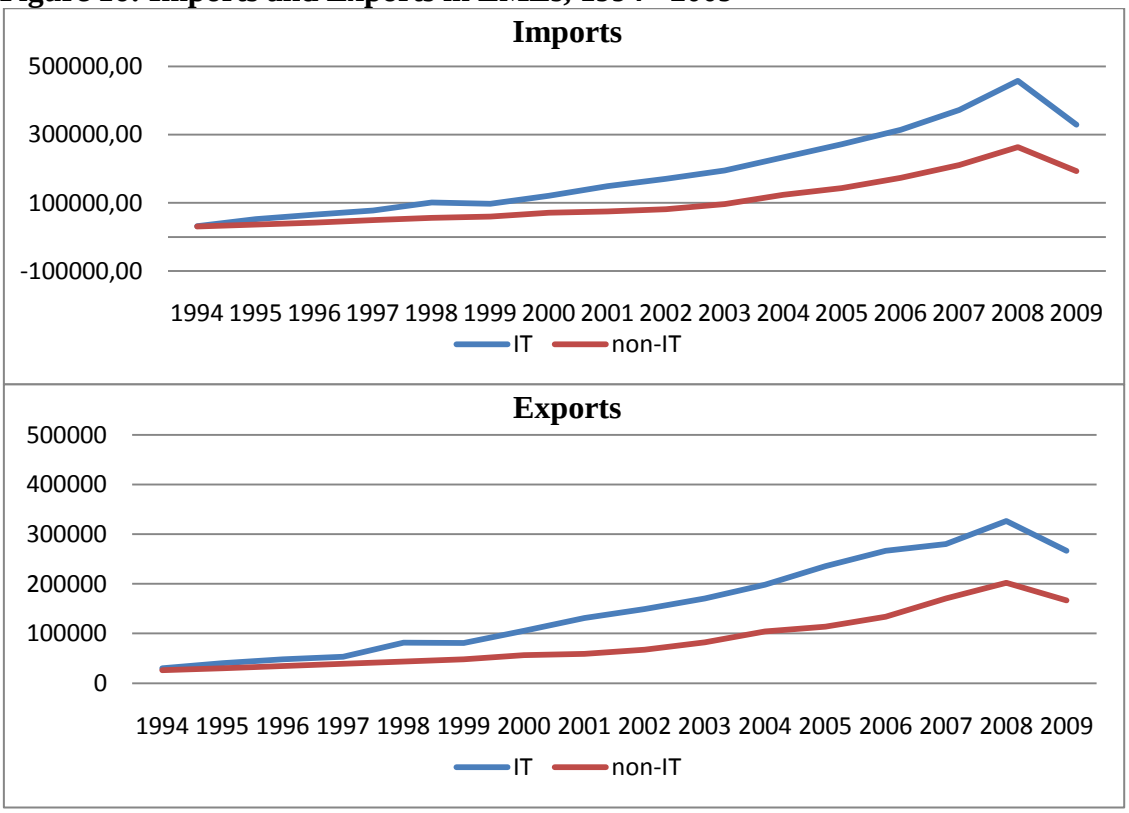
[16] IT = Albania, Hungary, Poland, Serbia, Indonesia, Philippines, Thailand, Brazil, Chile, Colombia, Peru, Ghana, South Africa
Non-IT = Bulgaria, Lithuania, Macedonia, China M (mainland), India, Pakistan, Vietnam, Paraguay, Venezuela, Malawi, Gambia, Nigeria

of the 2009 IT countries lowered the deposit rate. This might be because of the intention to keep inflation close to the targets helping the economy to recover while making the credit more accessible to the economic agents. On the contrary, the non-ITs were not decreasing the rate significantly and at the end of the 2010 increased the rate while at the same time ITs further decreased it. Unfortunately, the observations used for this particular case are limited for the last three months of the 2010. Therefore the depicted development of the interest rate from October to December 2010 rates might have been actually slightly different in reality.

6.2. The balance of trade

Regarding the trade balance of the emerging market economies of the interest, the values of the exports and imports performed by the IT and non-IT economies differed for major part of the tracked period. Following figure 16 shows the evolution of exports and imports from year 1994 to 2009 (national currency). Between years 1994 and 1997, the amounts of trade were similar for ITs and non-ITs but from 1998 the dispersion in magnitude is bigger and bigger and the IT countries are shifting away from values of non-IT in both exports and imports.

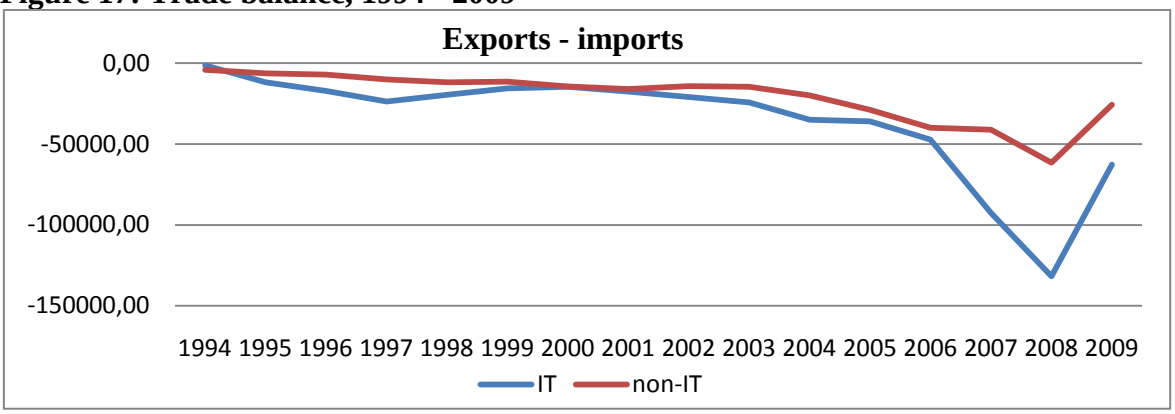
Figure 16: Imports and Exports in EMEs, 1994 - 2009



Source: (IMF 2011); own calculations

These facts determine the resulting deficit in trade for both groups of countries. The non-ITs perform the deficit of lower amounts however they showed lower amounts in both variables in the whole period and this might be a cause of less open economies while compared to IT countries (Ghani 2009). The trade balance over the period is depicted in the figure 17.

Figure 17: Trade balance, 1994 - 2009



Source: (IMF 2011); own calculations

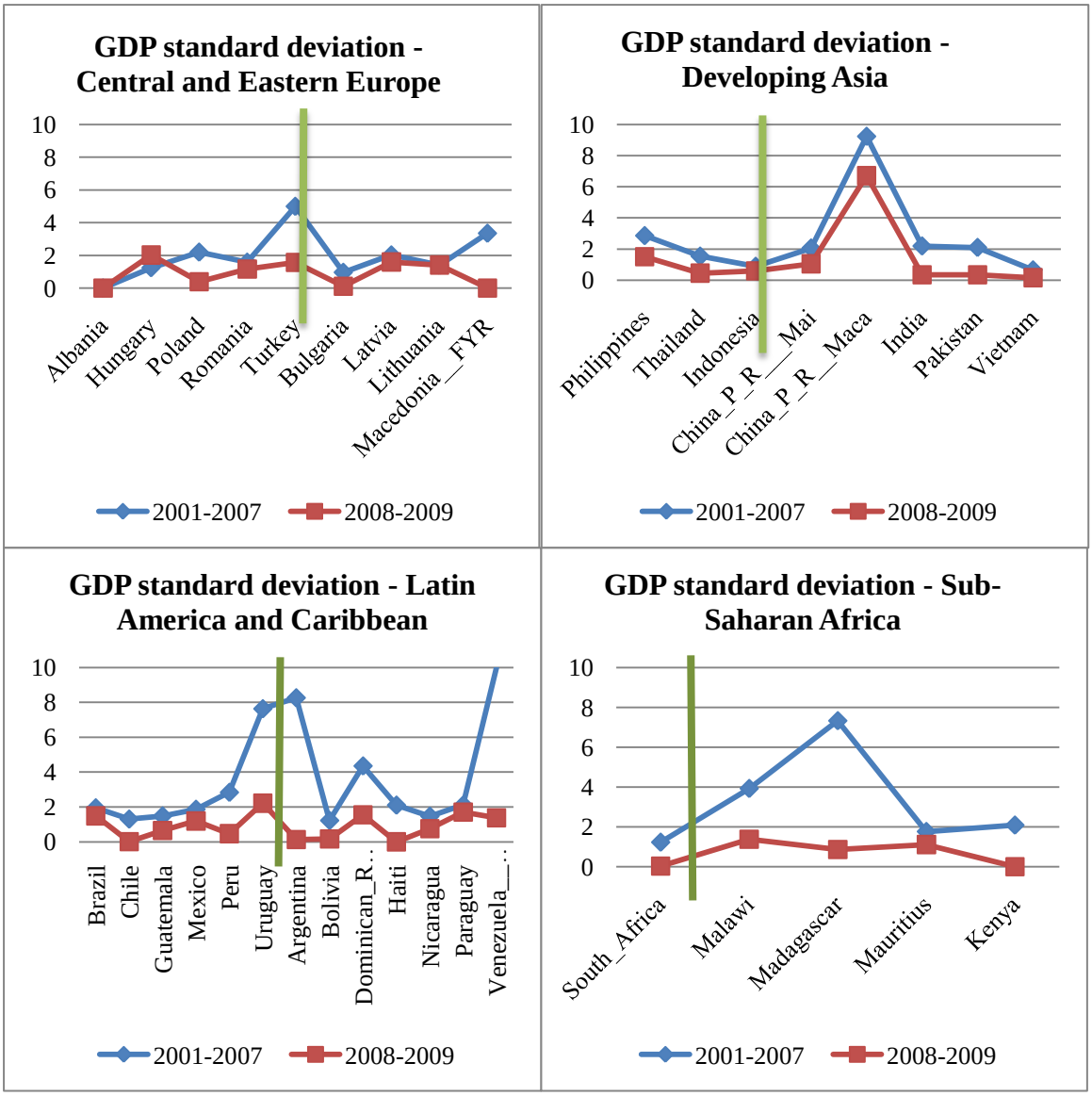
Since the exports and imports are of nominal values, the bottom of 2008 as shown in figure 17 reflects also the higher commodity prices that hit the global economy at that time. While trying to find the contribution of the IT regime, the regression for difference-in-differences (as introduced in chapter 5) was also run in this case. However, the results were not robust. Exports and imports have delivered positive coefficients of dummy variable in the pre-crisis state (2002 – 2007) but had not fit into the significance level and also the fit of the data was very low in both cases. The heteroskedasticity might have been present in the crisis period regressions (2007-2009). This would mean that during the crisis, the IT regime could not have been any help in the trade of the countries. However, the model used small number of observations (varying from 13 to 17) and this most probably stands behind the low R^2 and fit of the data.

6.3. GDP and CPI pre-crisis and crisis observations of volatility

Volatility of the GDP percentage change in volume is compared in the periods before and during the crisis. 2001-2007 stands for the pre-crisis period where all the IT countries already adopted inflation targeting (on the average the year 2002). The crisis period is here represented by values of years 2008 – 2009. The comparison is displayed in the figure 18 and the countries are grouped in to the categories of the geographical and economical closeness. In the graphs, the line with the diamond shaped points depicts the first period, 2001-2007, and the line with square shaped points shows the second period, 2008-2009. Unfortunately not enough data were available for the year 2010. The vertical line divides the countries in the graph, all countries on the left of the line are the IT countries and those on the right are non-IT countries.

The Central and Eastern Europe emerging economies performed lower volatility of the GDP than the group of non-IT countries for both periods. Even the change between the periods was higher for non-ITs (1.16%) than for IT countries (0.71%). This is probably caused by the lack of observations for the non-IT and extreme value of the Turkey standard deviation in first period. Regarding the countries from the Developing Asia region, the non-IT economies performed on average higher volatility in both periods, for 1.49% in the pre-crisis framework and for 0.87 % for the crisis period. Countries of the Latin America and Caribbean performed volatility of the GDP of 4.22 % for the non-ITs and 2.84 % for the ITs in the first period. The IT countries therefore performed better in the sense of higher economic stability.

Figure 18: The GDP standard deviation pre- and post-crisis observations

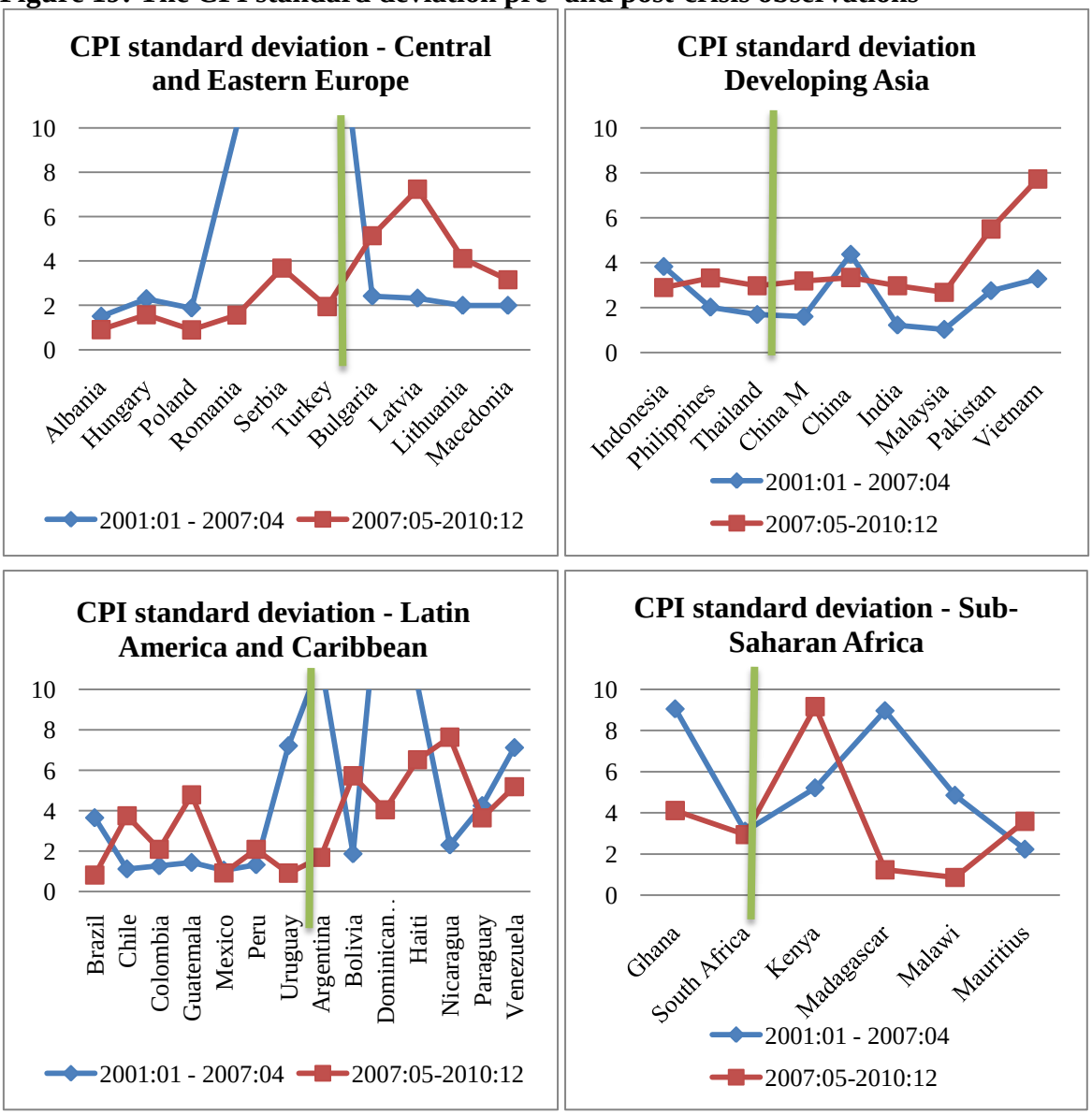


Source: (IMF 2011); own calculations

However, during the crisis, the volatility of the non-ITs decreased to the levels equal to those of ITs. Last graph includes unfortunately only one representative of the Sub-Saharan IT economy, which performed better (in terms of lower volatility) than the average of the non-ITs in both periods.

Similarly, the volatility of the inflation for the selected countries is displayed in the following set of tables of the standard deviations for the periods 2001:01 – 2007:04 and 2007:05 – 2010:12.

Figure 19: The CPI standard deviation pre- and post-crisis observations



Source: (IMF 2011); own calculations

The figure 19 presents standard deviations in the pre- and post- crisis periods for the respective categories of the countries. The vertical line divides the graph in the way that to the left of the line, the values of IT countries are displayed and to the right of the line, the values of the non-IT emerging market economies of the category are shown.

The upper left graph depicting the CEE countries show significant change in standard deviation between the periods for the IT economies. This is caused mainly by extreme values of Serbia and Turkey. However, the volatility of CPI decreased for the second period on average by 10.16 percentage points. The non-IT countries went conversely while they presented lower volatility in the first period and during the crisis and the average

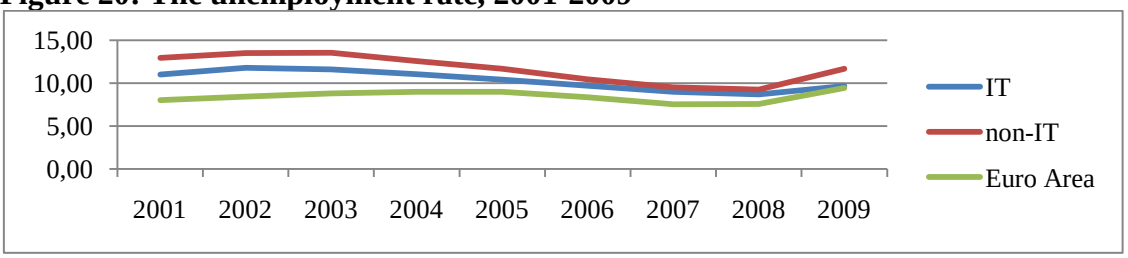
volatility for this subgroup increased by approximately 17.46 percentage points.[17] The Developing Asia (upper right graph of figure 19) IT countries faced similar volatilities before and during the crisis but still the values were higher in the second period, approximately by 0.55 percentage points. Same implies for the non-IT countries which before the crisis had similar volatility values to ITs but in the second period those values increased. The difference is in this case higher, the non-IT faced during the crisis approximately 1.86 percentage point higher volatility of CPI. The Latin America and Caribbean countries went through the decrease of CPI volatility. Change for the ITs was small, approximately 0.24 % but the non-IT showed 3.01% difference for crisis period. However, the high volatility for the non-ITs in the first period was enhanced especially by the Dominican Republic data, also Argentina and Haiti contributed to the high number. Therefore the behaviour of particular countries could have affected the results for the whole group. The last category, Sub-Saharan Africa, includes limited number of IT countries. Again, the decline for both ITs and non-ITs is present between the periods but it is bigger for the IT countries than for the rest of the sample (2.55% for ITs; 1.60 % for the non-ITs).

The evidence suggests that the IT countries were slightly more volatile in the first period than the non-ITs (5.73% and 4.44% respectively). However, in the crisis period, where the economies need the stabile variables more than in any other situation, the average CPI volatility was 2.63% for the ITs and 7.94% for the group of non-ITs. Therefore the countries using the IT performed better in the framework of the global financial crisis than corresponding emerging non-IT economies.

6.4. Unemployment rate

Regarding the unemployment rate, the regression ran for the data did not bring any evidence of the effects of the IT regime. The data show similar behaviour of the variable for the IT as well as the non-IT countries.

Figure 20: The unemployment rate, 2001-2009



Source: (IMF 2011); own calculations

[17] The data regarding the CPI % change in volume estimations in the figure 15 are presented in the Annex 4.

As depicted in the figure 20, the non-IT countries unemployment was on the average higher than in IT countries, but the difference was not large, it ranged between one and two percentage points. To enable the comparison with advanced countries unemployment rate for the same time framework, the Euro Area was chosen. The values were lower but from the 2005 followed same path as the emerging market economies. For all three groups, the unemployment rate declined and reached the bottom in 2008 from where it again started to increase. The raise was steepest for the non-IT countries and the IT countries faced smoothest increase from those three groups. It can be assumed that the IT regime helped with the stabilization of the economy in terms of volatility of inflation and the growth and therefore also the unemployment behaved in predictable and smooth way. However, as stated above, the difference in difference regression did not bring significant evidence to support the IT dummy in this case.

Table 24: Summary of statistics, unemployment rate, 2001-2009

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
IT					
Albania	14,38	14,28	12,75	16,40	1,26
Armenia	8,52	8,20	6,27	10,80	1,72
Brazil	10,07	9,97	7,89	12,32	1,54
Chile	8,17	7,81	7,12	10,00	1,02
Colombia	12,91	12,00	11,20	15,40	1,61
Hungary	7,02	7,13	5,72	10,01	1,39
Mexico	3,25	3,58	1,80	5,45	1,14
Peru	8,92	8,90	8,30	9,50	0,53
Philippines	9,69	11,10	7,30	11,80	2,05
Poland	15,94	16,22	9,93	19,92	3,85
Romania	6,58	6,29	3,98	9,97	2,00
South_Africa	24,63	23,93	22,30	28,85	2,19
Thailand	1,97	1,88	1,37	3,32	0,63
Turkey	10,53	10,30	8,35	14,01	1,49
Uruguay	12,16	12,20	7,32	17,00	3,73
Mean	10,32	10,25	8,11	12,98	**1,74**
Non-IT					
Argentina	12,55	11,58	7,90	18,06	4,08
Bulgaria	11,29	10,10	5,60	19,78	4,99
China_P_R___Mai	4,10	4,20	3,60	4,30	0,22
China_P_R__Maca	4,58	4,10	3,00	6,40	1,36
Dominican_Repub	16,17	16,10	14,10	18,40	1,36
Latvia	9,74	9,00	6,03	17,18	3,42
Lithuania	7,94	6,67	3,43	13,73	3,99

Macedonia__FYR	34,50	34,93	30,52	37,30	2,51
Mauritius	8,02	7,70	6,90	9,53	0,91
Pakistan	7,06	7,69	5,20	8,30	1,29
Venezuela__Rep_	12,02	12,25	7,36	18,00	3,82
Mean	11,63	11,30	8,51	15,54	**2,54**
Euro_Area	8,46	8,42	7,52	9,44	0,66

Source: (IMF 2011); own calculations

Table 24 summarises the main statistics characterising the unemployment rate from the 2001 to 2009. Regarding the movements in the unemployment rate before the crisis and during, following table depicts the data. The unemployment rate changed for both categories almost for the same percentage points, 0.72 % decline for the ITs and 0.79 % decline for the non-ITs. However, the non-ITs performed higher volatility in the rate both pre- and during the crisis, as presented by table 25.

Table 25: Standard deviation of the unemployment, periods 2001-2007 and 2008-2009

Variable	2001-2007	2008-2009	Variable	2001-2007	2008-2009
IT			**non-IT**		
Albania	1,07	0,16	Argentina	3,81	0,58
Armenia	1,50	0,39	Bulgaria	4,69	0,87
Brazil	1,14	0,13	China_P_R___Mai	0,23	0,07
Chile	0,94	1,40	China_P_R__Maca	1,32	0,42
Colombia	1,65	0,49	Dominican_Repub	1,11	0,57
Hungary	0,79	1,55	Latvia	2,20	6,86
Mexico	0,80	1,04	Lithuania	3,81	5,60
Peru	0,48	0,07	Macedonia__FYR	2,68	1,13
Philippines	1,86	0,05	Mauritius	0,96	0,17
Poland	2,61	0,77	Pakistan	1,14	0,00
Romania	2,00	1,64	Venezuela__Rep_	3,33	0,37
South_Africa	2,38	0,71	Mean	**2,30**	**1,51**
Thailand	0,64	0,11			
Turkey	0,74	2,15			
Uruguay	3,01	0,19			
Mean	**1,44**	**0,72**			

Source: (IMF 2011); own calculations

7. Possible future development

Organisations, such as the IMF, report the "two-speed recovery" that is performed by global economy. This division in recovery is caused by the slow growth and high unemployment rates in advanced economies (crucial are the stresses coming from the Euro Area) on one side and better performing emerging economies on the other side.

Forecasts are positive in terms of further growth for EMEs while it is expected to be of high values (6.5%). The Developing Asia grows as the fastest area, followed by Sub-Saharan Africa, which has a significant share on the growth of EMEs as a whole. This is happening mainly because of strong domestic demand and rising global commodity demand. It is expected that the prices of commodities will stay in high levels and that there might be fear of rising inflation in some of the EMEs. The fast growth in these countries is narrowing the difference between the actual and potential output. Therefore the overheating issues emerged. The overheating, rising inflation and possible difficulties to access the credit, since the tightening of advanced countries banks policies could spread to EMEs, are the main risks faced by EMEs.

These economies stand for 40% "of global consumption" and are performing 2/3 of the growth globally. Therefore is the development in these countries of crucial importance in the recovery for all economies in the world. The re-balance would be much difficult to achieve if the EMEs would perform a slowdown. This is the most important reason why to access the proper monetary policy for the EMEs and the inflation targeting seems to be the one which posses of good outcomes in economy stabilization and is therefore appropriate for the implementation.

Since advanced economies need to implement policies to enhance the growth, beneficial spillovers are expected in EMEs. There are going to face the need to manage the "capital inflows, overheating pressures and external re-balancing". Another issue can possibly emerge from the practice of the US, the quantitative easing, that might have affected the EMEs with the capital inflows. Since the quantitative easing brings the middle term rates to low values. However, in the situation of "overheating pressures", the monetary tightening would be more appropriate. But any strong limitations in inflows of credit would not be positive for the economies either. Therefore the balance in credit growth maintenance needs to be found to not to become "excessive" (IMF 2011).

Regarding the IT framework as such, the opinions on its future development differ among the relevant literature authors. There are of course advocates as well as opponents of this

framework. For example Carl Walsh, who is together with Lars Svensson the leader of the theoretical works done on the inflation targeting field (Posen 2008), suggests that the inflation targeting regime is well suited to survive the crisis. He points out that the financial crisis was one of the first "real tests" for this monetary policy regime, which is true especially for the majority of EMEs used in this work since the average year of adoption is for them 2002, but that it still can work well. This should be because of the flexibility of this regime, the anchored expectations of future inflation rates. That is in line with the aspect of credibility of the central bank under IT and its communication strategies of the policy to the public (Walsh, Inflation targeting: What have we learned? 2009).
On the other hand e.g. Adam Posen[18] changes his very positive view on the IT while he says that it is an overrated concept and that the central banks should be aware of "too low targets and too strict enforcement of it" since they could easily tighten the monetary policy too much, therefore should remain flexible as Walsh suggests above. Posen also points out that the accountability gains have not materialize and therefore should not be stated as possible benefits of the IT regime (Posen 2008).

Discussion relating to the IT and crisis can be shown on the following two contradictory examples. The first view is negative in terms of IT and suggests that this regime is an inadequate approach of "one-tool one target" as stated e.g by Blanchflower. According to this view, the IT cannot work "alone" and new tools are required to be included in to the regime. Those tools should cover the issues of "global imbalances, perception of risk in economy and stress in financial sector" which according to those authors lacks so far in the IT. Other requirements are e.g. macro-prudential instruments that needs to be added, such as to influence of bank lending behaviour, or the inclusion of the prices of houses into the CPI (Blanchflower 2009).
The second view is here represented by Wren-Lewis, who suggests that there is no need to re-assess the monetary policy because of the crisis. He says that it was caused by "too lax" regulation and therefore the regulatory tools to control financial sector are needed rather than the changes in IT itself (Wren-Lewis 2010).

[18] Adam Posen is deputy director of the Peterson Institute for International Economics, Washington, DC (Posen 2008).

8. Conclusion

This work estimated data for selected emerging countries and through the comparison and regressions of the main economic indicators evaluated the performance of the IT countries in relation to the non-IT economies through previous years and especially through the crisis of 2007-2010. The countries from the control group were selected as the representatives of monetary policy frameworks other than IT. The results are applicable as a comparison of the regimes. However, the future works could use the data more separately and assess the monetary frameworks in contrast to each other. This work takes the other regimes, monetary aggregate target and exchange rate anchor, mostly together as the one alternative to the IT.

Significant results supporting the presence of inflation targeting effects on the selected EMEs are derived in this work. These are the issues of less volatile behaviour of main economic indicators, CPI and GDP, and the overall more stable economic environment.

Regarding the CPI changes, IT countries performed greater reduction in this variable than the non-ITs for the pre-crisis period of 1990-2007. This is underlined with the regression outcomes which assign -2.7% additional reduction of CPI for the countries using the IT regime. During the crisis, the dummy coefficient of the interest should be positive since it would help to preserve inflation rate in positive values and prevent possible problems caused by deflation. This assumption was also confirmed by the regression and therefore the additional help of IT regime in terms of low, positive levels of inflation rate was performed during the crisis. The volatility of the main variable of the interest, CPI, was according to the regressions also lower for IT countries. It showed lower values in both pre-crisis and crisis periods and therefore indicated more stable environment in IT countries than in non-IT countries. Lower volatility was even more significant during the crisis, therefore the IT framework can be assumed as better performing in these severe economic situations.

Estimating the GDP percentage changes in volume, the behaviour of this variable was not that strongly positive as in some other works. From the simple comparison was derived that the IT countries have not changed much in the values of GDP % change in the period before the crisis (-0.05%) however the non-ITs have increased the values (4.37%). The models suggested that the changes in GDP volume were smaller and even of negative sign for the IT countries for both periods. Although some of the results have not showed

corresponding significance of the dummy coefficient of negative value. The non-IT countries performed bigger and positive percentage changes in GDP volume in the first period. During the crisis both groups faced severe declines in GDP % change according to the data, -6.76% for ITs and -9.29% for non-ITs. Models have delivered very low positive coefficient of dummy, which would be supportive for the IT regime in terms of ability to maintain positive GDP % change during the crisis, however the outcome was not significant.

The variety of issues which might have contributed to this evolution of the GDP changes in the IT EMEs and their non-IT counterparts could have influenced the outcomes of the regressions. The IT countries begun with higher GDP % change values in 1980 than non-ITs but the values for 2007 show that the ITs remained almost at the same level but the non-ITs increased the values for approximately 4%. This would be the state of the beta convergence since the IT countries could have already reached the higher convergence state and therefore later grew on the lower level than the non-ITs, therefore the GDP percentage changes would be lower.

To ensure that the individual years, used for estimations presented above, do not stay for extremes of values achieved, e.g. because of the different position in the business cycle etc. the regressions using averages of the periods pre- and after-adoption of IT were run. The model again showed lower GDP % change for those periods and on average the movements in the variable were 0.72% for ITs and 1.92% for non-ITs. Therefore the data have not proved existence of additional increase in GDP percentage changes in volume under the IT framework. Regarding the variability of the GDP, it was lower for both pre-crisis and crisis periods. Before the crisis, the IT countries experienced additional -1.2% decrease in GDP volatility compared to non-ITs. The crisis state meant increase in volatility for both groups of countries however the IT countries performed lower volatility than non-ITs (3.82% and 4.55% respectively).

The behaviour of other selected variables indicating the state of the economies of interest was following. The national interest rate (CB discount rate) performed lower volatility in the IT economies than in the non-IT countries. Before the crisis, the rates in both groups followed similar path. From the peak in 2008 the ITs were lowering the IR enabling the economies a possible recovery but the non-ITs showed almost no decline and at the end of 2010 even increased the values. This could be possible due to the pressure on the fixed ER faced during the crisis. ITs at the same time decreased the IR values further. The

unemployment rate data behaved similar through the periods for both groups of MP regimes and the regression have not delivered any plausible outcome. However, on the average the non-ITs performed higher unemployment rate than the IT countries. The countries hit the bottom of the unemployment rate in the 2008 and after that the ITs performed the smoothest increase in values and the non-ITs faced steep increase in unemployment rate after the bottom state. This also explains the higher volatility of this rate performed by the non-ITs (2.54%) than by ITs (1.74%). The ER per SDR showed that for the IT economies is less volatile and therefore its smoother behaviour might support the predictability of the trade conditions in the IT countries. Increased predictability is actually aim of the CB under the IT since it contributes to maintain the credibility.

According to the delivered outcomes it can be said that the IT proved as a reasonable and suitable monetary policy to maintain the price stability and less volatile economic indicators in the emerging market economies. Compared to emerging countries not adopting inflation targeting, the ITs performed lower volatility of the GDP and CPI as well as lower CPI levels which can be to certain level attributed to the IT regime. This holds especially for the crisis period where IT regime contributed to the performance of the IT countries also significantly and showed its ability to enhance the economic performance of the EMEs under the severe circumstances.

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Annex 1: Preconditions and current conditions

	Inflation Targeters				Non-inflation-targeters	
	Emerging markets		Industrial countries		Emerging markets	
	Pre-adoption	Current	Pre-adoption	Current	Pre-adoption of current regime	Current
Technical infrastructure	**0.29**	**0.97**	**0.74**	**0.98**	**0.51**	**0.62**
Data availability	0.63	0.92	0.84	0.94	0.65	0.70
Systematic forecast process	0.10	1.00	1.00	1.00	0.60	0.80
Models capable of conditional forecasts	0.13	1.00	0.38	1.00	0.28	0.35
Financial system health	**0.41**	**0.48**	**0.53**	**0.60**	**0.40**	**0.49**
Bank regulatory capital to risk-weighted assets	0.75	1.00	0.75	1.00	0.71	0.86
Stock market capitalization to GDP	0.16	0.21	0.28	0.44	0.16	0.19
Private bond market capitalization to GDP	0.10	0.07	0.40	0.31	0.29	0.20
Stock market turnover ratio	0.29	0.22	0.28	0.35	0.37	0.45
Currency mismatch	0.92	0.96	1.00	1.00	0.67	0.97
Maturity of bonds	0.23	0.43	0.46	0.52	0.18	0.29
Institutional independence	**0.59**	**0.72**	**0.56**	**0.78**	**0.49**	**0.64**
Fiscal obligation	0.77	1.00	0.75	1.00	0.50	0.70
Operational independence	0.81	0.96	0.63	1.00	0.70	1.00
Central bank legal mandate	0.50	0.62	0.16	0.44	0.40	0.55
Governor's job security	0.85	0.85	1.00	1.00	0.80	0.80
Fiscal balance in percent of GDP	0.48	0.47	0.45	0.78	0.38	0.42
Public debt in percent of GDP	0.47	0.47	0.53	0.54	0.35	0.46
Central bank independence	0.26	0.64	0.44	0.72	0.32	0.55
Economic structure	**0.36**	**0.46**	**0.47**	**0.55**	**0.55**	**0.44**
Exchange rate pass-through	0.23	0.44	0.31	0.50	0.33	0.42
Sensitivity to commodity prices	0.35	0.42	0.44	0.56	0.67	0.55
Extent of dollarization	0.69	0.75	1.00	1.00	0.63	0.60
Trade openness	0.18	0.21	0.13	0.16	0.56	0.19

Sources: Arnone and others (2005); IMF, *Global Financial Stability Report;* IMF, *International Financial Statistics;* national sources; OECD; Ramón-Ballester and Wezel (2004); World Bank, Financial Structure and Economic Development Database; and IMF staff calculations.

Source: (Batini, Kuttner a Laxton 2005, 176)

Annex 2 Monetary policy regimes

Exchange rate arrangement (Number of countries)	Monetary Policy Framework							
	Exchange rate anchor				Monetary aggregate target	Inflation targeting framework		Other1
	U.S. dollar (66)		Euro (27)	Composite (15)	Other(7)	(22)	(44)	(11)
Exchange arrangement with no separate legal tender (10)	Ecuador El Salvador Marshall Islands Micronesia, Fed. States of	Palau Panama Timor-Leste	Montenegro San Marino		Kiribati			
Currency board arrangement (13)	Antigua and Barbuda[2] Djibouti Dominica[2] Grenada[2] Hong Kong SAR St. Kitts and Nevis[2]	St. Lucia[2] St. Vincent and the Grenadines[2]	Bosnia and Herzegovina Bulgaria Estonia[3] Lithuania[3]		Brunei Darussalam			
Other conventional fixed peg arrangement (68)	Angola Argentina Aruba Bahamas, The Bahrain Bangladesh Barbados Belarus Belize Eritrea Guyana Honduras Jordan Kazakhstan Lebanon Malawi Maldives Mongolia Netherlands Antilles Oman Qatar Rwanda Saudi Arabia	Seychelles Sierra Leone Solomon Islands Sri Lanka Suriname Tajikistan Trinidad and Tobago Turkmenistan United Arab Emirates Venezuela, Rep. Bolivariana de Vietnam Yemen, Rep. of Zimbabwe	Benin[4] Burkina Faso[4] Cameroon[5] Cape Verde Central African Rep.[5] Chad[5] Comoros Congo, Rep. of[5] Côte d'Ivoire[4] Croatia Denmark[3] Equatorial Guinea[5] Gabon[5] Guinea-Bissau[4] Latvia[3] Macedonia, FYR Mali[4] Niger[4] Senegal[4] Togo[4]	Fiji Kuwait Libya Morocco Russian Federation Samoa Tunisia	Bhutan Lesotho Namibia Nepal Swaziland	Argentina Malawi Rwanda Sierra Leone		
Pegged exchange rate within horizontal bands (3)			Slovak Rep.[3]	Syria. Tonga				
Crawling peg (8)	Bolivia China Ethiopia Iraq Nicaragua Uzbekistan			Botswana Iran, I.R. of.				
Crawling band (2)	Costa Rica			Azerbaijan				

Managed floating with no pre-determined path for the exchange rate (44)	Cambodia Kyrgyz Rep. Lao P.D.R. Liberia Mauritania Mauritius Myanmar Ukraine			Algeria Singapore Vanuatu		Afghanistan, I.R. of Burundi Gambia, The Georgia Guinea Haiti Jamaica Kenya Madagascar Moldova Mozambique Nigeria Papua New Guinea São Tomé and Príncipe Sudan Tanzania Uganda	Armenia[6] Colombia Ghana Guatemala Indonesia Peru Romania Serbia[6] Thailand Uruguay		Dominican Rep. Egypt India Malaysia Pakistan Paraguay
Independently floating (40)						Zambia	Albania Australia Austria[7] Belgium[7] Brazil Canada Chile Cyprus[7] Czech Rep. Finland[7] France[7] Germany[7] Greece[7] Hungary Iceland Ireland[7] Israel Italy[7] Korea, Rep. of	Luxembourg[7] Malta[7] Mexico Netherlands[7] New Zealand Norway Philippines Poland Portugal[7] Slovenia[7] South Africa Spain[7] Sweden Turkey United Kingdom	Congo, Dem. Rep. of Japan Somalia[8] Switzerland United States

Source: (IMF 2008)

1 Includes countries that have no explicitly stated nominal anchor, but rather monitor various indicators in conducting monetary policy.
2 The member participates in the Eastern Caribbean Currency Union.
3 The member participates in the ERM II.
4 The member participates in the West Africa Economic and Monetary Union.
5 The member participates in the Central African Economic and Monetary Community.
6 The central bank has taken preliminary step toward inflation targeting and is preparing for the transition to full-fledged inflation targeting.
7 The member participates in the European Economic and Monetary Union.
8 As of end-December 1989.
Source: (IMF 2008)

Annex 3 Groups of countries according to the level of a development

Advanced Economies
Euro Area Major Advanced Economies (G7) Newly Industrialized Asian Economies Other Advanced Economies (Advanced Economies excluding G7 and Euro Area) European Union
Emerging and Developing Economies
Central and Eastern Europe Commonwealth of Independent States Developing Asia

ASEAN-5
Latin America and the Caribbean
Middle East and North Africa
Sub-Saharan Africa

Advanced Economies		
Australia	Iceland	Singapore
Austria	Ireland	Slovak Republic
Belgium	Israel	Slovenia
Canada	Italy	Spain
Cyprus	Japan	Sweden
Czech Republic	Korea	Switzerland
Denmark	Luxembourg	Taiwan Province of China
Finland	Malta	United Kingdom
France	Netherlands	United States
Germany	New Zealand	
Greece	Norway	
Hong Kong SAR	Portugal	

Euro Area		
Austria	Germany	Netherlands
Belgium	Greece	Portugal
Cyprus	Ireland	Slovak Republic
Estonia	Italy	Slovenia
Finland	Luxembourg	Spain
France	Malta	

(Additional source: http://www.ecb.int/euro/intro/html/map.en.html)

Major Advanced Economies (G7)	
Canada	Japan
France	United Kingdom
Germany	United States
Italy	

Newly Industrialized Asian Economies	
Hong Kong SAR	Singapore
Korea	Taiwan Province of China

Other Advanced Economies (Advanced Economies excluding G7 and Euro Area)		
Australia	Israel	Sweden
Czech Republic	Korea	Switzerland

Denmark	New Zealand	Taiwan Province of China
Hong Kong SAR	Norway	
Iceland	Singapore	

European Union		
Austria	Germany	Netherlands
Belgium	Greece	Poland
Bulgaria	Hungary	Portugal
Cyprus	Ireland	Romania
Czech Republic	Italy	Slovak Republic
Denmark	Latvia	Slovenia
Estonia	Lithuania	Spain
Finland	Luxembourg	Sweden
France	Malta	United Kingdom

Emerging and Developing Economies		
Afghanistan, Islamic Republic of	Gambia, The	Oman
Albania	Georgia	Pakistan
Algeria	Ghana	Panama
Angola	Grenada	Papua New Guinea
Antigua and Barbuda	Guatemala	Paraguay
Argentina	Guinea	Peru
Armenia	Guinea-Bissau	Philippines
Azerbaijan	Guyana	Poland
Bahamas, The	Haiti	Qatar
Bahrain	Honduras	Romania
Bangladesh	Hungary	Russia
Barbados	India	Rwanda
Belarus	Indonesia	Samoa
Belize	Iran, Islamic Republic of	São Tomé and Príncipe
Benin	Iraq	Saudi Arabia
Bhutan	Jamaica	Senegal
Bolivia	Jordan	Serbia
Bosnia and Herzegovina	Kazakhstan	Seychelles
Botswana	Kenya	Sierra Leone
Brazil	Kiribati	Solomon Islands
Brunei Darussalam	Kosovo	South Africa
Bulgaria	Kuwait	Sri Lanka
Burkina Faso	Kyrgyz Republic	St. Kitts and Nevis
Burundi	Lao People's Democratic Republic	St. Lucia

Cambodia	Latvia	St. Vincent and the Grenadines
Cameroon	Lebanon	Sudan
Cape Verde	Lesotho	Suriname
Central African Republic	Liberia	Swaziland
Chad	Libya	Syrian Arab Republic
Chile	Lithuania	Tajikistan
China	Macedonia, Former Yugoslav Republic of	Tanzania
Colombia	Madagascar	Thailand
Comoros	Malawi	Timor-Leste
Congo, Democratic Republic of	Malaysia	Togo
Congo, Republic of	Maldives	Tonga
Costa Rica	Mali	Trinidad and Tobago
Côte d'Ivoire	Mauritania	Tunisia
Croatia	Mauritius	Turkey
Djibouti	Mexico	Turkmenistan
Dominica	Moldova	Uganda
Dominican Republic	Mongolia	Ukraine
Ecuador	Montenegro	United Arab Emirates
Egypt	Morocco	Uruguay
El Salvador	Mozambique	Uzbekistan
Equatorial Guinea	Myanmar	Vanuatu
Eritrea	Namibia	Venezuela
Estonia	Nepal	Vietnam
Ethiopia	Nicaragua	Yemen, Republic of
Fiji	Niger	Zambia
Gabon	Nigeria	Zimbabwe

Source: (IMF 2008)

Annex 4 Statistics for the CPI % change in volume, periods 2001-2007 and 2007-2010

Statistics for Central and Eastern Europe before the crisis, observations 2001:01 - 2007:04

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeting countries					
Albania	3,0289	2,828	0,27578	7,7185	1,5032
Hungary	5,7113	5,5467	2,2878	10,777	2,292
Poland	2,4792	1,6654	0,078186	7,4627	1,8717
Romania	16,059	13,4	3,655	40,321	10,082
Serbia	27,628	13,376	3,4173	134,88	36,249
Turkey	25,418	13,256	8,7169	73,157	19,564
Exchange rate targeting countries					
Bulgaria	5,6469	5,6641	-0,55177	9,8164	2,4159
Latvia	4,6538	4,5682	0,60753	8,8656	2,3193
Lithuania	1,513	1,9298	-1,925	4,8591	1,9915
Macedonia	2,1894	2,022	-0,82076	6,9755	1,9915

Statistics for the Central and Eastern Europe for the crisis, observations 2007:05 - 2010:12

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeters					
Albania	3,0734	3,0466	1,4649	4,6506	0,90786
Hungary	5,5191	5,4491	2,8957	8,5713	1,5775
Poland	3,4362	3,667	1,5306	5,0251	0,89338
Romania	6,3008	6,6202	3,801	9,0424	1,5616
Serbia	8,6018	8,1936	3,0864	3,0864	3,6768
Turkey	8,3472	8,3774	5,0761	12,065	1,9434
Exchange rate targeters					
Bulgaria	6,6582	4,8343	-0,25165	15,279	5,134
Latvia	6,9443	8,2186	-4,1345	17,929	7,2344
Lithuania	5,7734	5,1815	-0,46838	12,523	4,1152
Macedonia	3,2406	2,5787	-1,5172	8,8209	3,1529

Statistics for Developing Asia before the crisis, observations 2001:01 - 2007:04

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeters					
Indonesia	9,8067	8,5299	4,6135	18,381	3,8292
Philippines	5,3833	5,3561	2,1946	8,5714	2,0165
Thailand	2,6609	2,2777	0,23419	6,3123	1,6888
Others					
China M	1,4592	1,35	-1,3	5,3	1,6007
China	1,6969	-0,41005	-3,404	10,54	4,3744
India	4,4204	4,2418	2,2312	7,563	1,2194
Malaysia	2,0682	1,6634	0,38536	4,7619	1,0259
Pakistan	5,7128	5,3777	1,4051	11,098	2,751
Vietnam	5,1007	5,0897	-1,8745	10,238	3,2819

Statistics for Developing Asia during the crisis, observations 2007:05 - 2010:12

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeters					
Indonesia	6,5651	6,2739	2,4144	12,151	2,8934

Philippines	4,9797	4,0836	0,062383	12,412	3,3172
Thailand	2,5702	2,9774	-4,3836	9,1725	2,9728
Others					
China M	3,3395	3,4	-2	8,7	3,182
China	4,5592	3,9577	-1,183	9,5708	3,3379
India	9,6422	9,6296	5,4688	16,216	2,9687
Malaysia	2,469	1,9504	-2,4411	8,5147	2,6751
Pakistan	14,493	13,186	6,3737	25,33	5,4989
Vietnam	12,358	9,2158	1,9771	28,312	7,724

Statistics for Latin America and Caribbean before the crisis, observations 2001:01 - 2007:04

	Mean	**Median**	**Minimum**	**Maximum**	**Std. Dev.**
Inflation targeters					
Brazil	7,6927	7,1173	2,9633	17,231	3,643
Chile	2,7266	2,8051	-0,74707	4,6944	1,113
Colombia	6,0865	5,9769	3,9383	8,4922	1,2653
Guatemala	7,1844	7,1947	4,1739	9,8442	1,4307
Mexico	4,6786	4,4762	2,9113	8,115	1,0508
Peru	1,8683	1,8803	-1,1114	4,6128	1,3189
Uruguay	9,6277	6,6459	3,4227	28,512	7,2023
Others					
Argentina	10,703	8,9331	-1,7445	40,953	11,381
Bolivia	3,5052	3,9262	-1,2652	7,1912	1,8606
Dominican Republic	16,98	8,8968	-0,99992	65,292	18,34
Haiti	18,638	15,279	7,9858	42,456	10,211
Nicaragua	7,1463	7,0713	3,1438	10,815	2,298
Paraguay	8,7515	7,9925	1,6304	20,854	4,2419
Venezuela	19,579	17,974	10,314	38,679	7,1086

Statistics for Sub-Saharan Africa before the crisis, observations 2001:01 - 2007:04

	Mean	**Median**	**Minimum**	**Maximum**	**Std. Dev.**
Inflation targeters					
Ghana	18,55	14,873	8,7689	41,944	9,05
South Africa	5,1063	4,7554	0,16447	13,007	3,1027
Others					
Kenya	8,9361	8,7549	0,44547	19,142	5,2088
Madagascar	11,083	10,857	-8,4465	29,321	8,9616
Malawi	14,399	14,237	8,4161	29,321	4,8507
Mauritius	5,9271	5,6402	3,1414	12,276	2,2269

Statistics for Sub-Saharan Africa during the crisis, observations 2007:05 - 2010:12

	Mean	**Median**	**Minimum**	**Maximum**	**Std. Dev.**
Inflation targeters					

Ghana	14,666	14,509	8,5761	20,742	4,1128
South Africa	7,63	7,0391	3,214	13,715	2,9419
Others					
Kenya	12,822	10,827	3,1732	29,993	9,1569
Madagascar	9,0855	9,133	6,8507	11,663	1,2357
Malawi	8,1571	7,9395	7,0057	10,052	0,86651
Mauritius	5,6977	5,1745	0,085324	11,72	3,5933

(Source: IMF IFS 02/11; own calculations)

Annex 5 Statistics for the GDP % change in volume, periods 2001-2007 and 2008-2009

Statistics for Central and Eastern Europe before the crisis, observations 2001-2007

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeting countries					
Albania	5,51744	undefined	5,51744	5,51744	0
Hungary	3,427	3,77335	0,772868	4,5244	1,24449
Poland	4,07008	3,86716	1,2053	6,78527	2,19863
Romania	6,09331	5,55748	4,12448	8,47653	1,58267
Turkey	5,0083	6,16384	-5,69748	9,36281	5,00268
non-inflation targeting countries					
Bulgaria	5,6201	6,16726	4,06581	6,64167	0,961799
Latvia	9,02872	8,67628	6,4716	12,2328	2,02616
Lithuania	8,09769	7,80223	6,73595	10,2467	1,3988
Macedonia	1,84606	3,28237	-4,52549	4,10204	3,35346

Statistics for Central and Eastern Europe - the crisis, observations 2008-2009

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeting countries					
Hungary	-2,93257	-2,93257	-6,69269	0,82754	5,31761
Poland	3,38219	3,38219	2,04699	4,71738	1,88825
Romania	0,10919	0,10919	-7,13148	7,34986	10,2399
Turkey	-2,0146	-2,0146	-4,68803	0,658839	3,78081
non-inflation targeting countries					
Bulgaria	0,497265	0,497265	-5,02688	6,02141	7,81232
Latvia	-11,0999	-11,0999	-17,9557	-4,24404	9,69561
Lithuania	-5,90712	-5,90712	-14,7417	2,92745	12,494

Statistics for Developing Asia before the crisis, observations 2001-2007

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeting countries					
Philippines	6,65509	5,53739	3,40024	12,4094	2,85552
Indonesia	5,07039	5,03087	3,6435	6,34502	0,879848
Thailand	5,09259	5,31757	2,16726	7,03293	1,53797

non-inflation targeting countries					
China_M	10,806	10,085	8,30032	14,1624	2,05742
China	14,8405	14,1646	2,88837	27,3205	9,22987
India	7,72206	8,51795	3,83655	9,7102	2,19007
Malaysia	5,16311	5,7885	0,517675	6,78344	2,11668
Pakistan	5,27854	5,68318	1,98243	7,66808	2,0943
Vietnam	7,74755	7,78993	6,8949	8,45634	0,652638

Statistics for Developing Asia - the crisis, observations 2008-2009

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeting countries					
Philippines	5,18342	5,18342	4,01135	6,35549	1,65756
Indonesia	5,27623	5,27623	4,54588	6,00657	1,03286
Thailand	0,107545	0,107545	-2,24774	2,46283	3,33088
non-inflation targeting countries					
China_M	9,37387	9,37387	9,11307	9,63467	0,368827
China	7,13499	7,13499	1,32557	12,9444	8,21575
India	7,07814	7,07814	6,71681	7,43947	0,510998
Malaysia	1,49727	1,49727	-1,71375	4,70829	4,54107
Pakistan	2,61422	2,61422	1,59594	3,6325	1,44007
Vietnam	5,81715	5,81715	5,32338	6,31091	0,698289

Statistics for Latin America and Caribbean before the crisis, observations 2001-2007

	Mean	Median	Minimum	Maximum	Std. Dev.
Inflation targeting countries					
Brazil	3,43429	3,16	1,15	6,08	1,95239
Chile	4,32412	4,58995	2,18411	6,04109	1,30789
Colombia	9,66891	10,1392	6,77598	13,2501	2,15886
Guatemala	3,83236	3,26011	2,3331	6,30406	1,48532
Mexico	2,55665	3,27536	-0,0328261	5,05877	1,8694
Peru	5,40289	5,55844	0,184471	8,69498	2,84021
Uruguay	2,56986	4,32533	-11,0319	11,82	7,63371
non-inflation targeting countries					
Argentina	4,12393	8,65924	-10,8945	9,17895	8,26253
Bolivia	3,54812	4,1733	1,6838	4,79701	1,22821
Dominican_Repub	5,29494	5,78821	-0,253359	10,6712	4,35506
Haiti	-0,0563332	0,0560405	-3,5163	2,31706	2,10774
Nicaragua	3,29476	3,08114	0,753939	5,31217	1,47153
Paraguay	3,42156	3,83961	-0,0485685	6,76134	2,11675
Venezuela	4,87649	8,40028	-8,85565	18,2866	10,0176

Statistics for Latin America and Caribbean - the crisis, observations 2008-2009

Mean	Median	Minimum	Maximum	Std. Dev.

Inflation targeting countries					
Brazil	2,475	2,475	-0,19	5,14	3,76888
Chile	1,07956	1,07956	-1,52635	3,68547	3,68531
Guatemala	1,93673	1,93673	0,57397	3,29949	1,92723
Mexico	-2,2396	-2,2396	-6,0068	1,52761	5,32763
Peru	5,35686	5,35686	0,875454	9,83827	6,33767
Uruguay	5,6965	5,6965	2,85774	8,53526	4,01461
non-inflation targeting countries					
Argentina	3,80744	3,80744	0,651597	6,96329	4,46304
Bolivia	6,1485	undefined	6,1485	6,1485	0
Dominican_Repub	4,35485	4,35485	3,45405	5,25565	1,27392
Nicaragua	0,65364	0,65364	-1,45243	2,75971	2,97843
Paraguay	0,99001	0,99001	-3,84438	5,8244	6,83686
Venezuela	4,82014	undefined	4,82014	4,82014	0

Statistics for Sub-Saharan Africa before the crisis, observations 2001-2007

	Mean	**Median**	**Minimum**	**Maximum**	**Std. Dev.**
Inflation targeting countries					
South_Africa	4,33652	4,55454	2,73546	5,60372	1,22406
non-inflation targeting countries					
Malawi	3,57514	5,51849	-4,14632	7,70997	3,92296
Madagascar	3,46459	5,25427	-12,6811	9,80074	7,32562
Mauritius	3,60427	3,94762	1,24117	5,75403	1,76056
Kenya	4,02896	4,43325	0,545282	6,11033	2,08347

Statistics for Sub-Saharan Africa - the crisis, observations 2008-2009

	Mean	**Median**	**Minimum**	**Maximum**	**Std. Dev.**
Inflation targeting countries					
South_Africa	0,94695	0,94695	-1,68218	3,57608	3,71815
non-inflation targeting countries					
Malawi	8,16403	8,16403	7,54174	8,78632	0,880051
Madagascar	1,27956	1,27956	-4,57024	7,12936	8,27287
Mauritius	3,38207	3,38207	1,67484	5,0893	2,41439

Annex 6 Standard deviation and mean values of the GDP % volume change in periods B(1990-2001) and F(2001-2010), IT countries

Std.Dev.	Beginning	Final	Change	Mean	Beginning	Final	Change
Central and Eastern Europe				Central and Eastern Europe			
Hungary	4,89	3,54	-1,35	**Hungary**	0,63	2,01	1,39
Poland	7,79	1,84	-5,95	**Poland**	3,32	4,00	0,69
Romania	6,29	6,23	-0,06	**Romania**	0,35	3,71	3,35
Turkey	4,89	5,08	0,19	**Turkey**	4,58	1,88	-2,70
Latin America and Caribbean				Latin America and Caribbean			
Brazil	2,28	2,19	-0,08	**Brazil**	2,17	3,05	0,88
Chile	3,73	2,43	-1,30	**Chile**	6,38	3,29	-3,09
Colombia	2,97	3,11	0,14	**Colombia**	2,89	3,09	0,20
Guatemala	0,81	2,22	1,41	**Guatemala**	3,71	3,76	0,05
Mexico	3,53	3,26	-0,27	**Mexico**	3,37	1,49	-1,87
Peru	4,59	2,88	-1,72	**Peru**	3,10	6,04	2,94
Uruguay	3,70	6,67	2,97	**Uruguay**	2,83	2,79	-0,04
Developing Asia				Developing Asia			
Indonesia	5,05	0,68	-4,37	**Indonesia**	4,48	5,62	1,14
Philippines	2,21	2,55	0,34	**Philippines**	3,14	6,69	3,56
Thailand	6,22	2,68	-3,54	**Thailand**	5,23	4,06	-1,17
Sub-Saharan Africa				Sub-Saharan Africa			
South Africa	2,15	2,13	-0,02	**South Africa**	1,64	3,64	2,00

Source: (IMF 2011); own calculations

Standard deviation and mean values of the GDP % volume change in periods B(1990-2001) and F(2001-2010), non-IT countries

Std. Dev.	Beginning	Final	Change	Mean	Beginning	Final	Change
Central and Eastern Europe				Central and Eastern Europe			
Bulgaria	5,67	3,66	-2,01	**Bulgaria**	-1,12	4,48	5,61
Latvia	12,34	9,68	-2,66	**Latvia**	-1,67	4,56	6,23
Lithuania	10,07	7,69	-2,38	**Lithuania**	-1,86	4,99	6,84
Macedonia	4,49	3,35	-1,14	**Macedonia**	-1,16	1,85	3,00
Latin America and Caribbean				Latin America and Caribbean			
Argentina	5,37	7,33	1,96	**Argentina**	3,00	4,05	1,06
Bolivia	1,64	1,46	-0,18	**Bolivia**	3,68	3,87	0,20
Dominican Republic	4,22	3,82	-0,40	**Dominican Republic**	4,77	5,09	0,32
Haiti	5,37	2,11	-3,26	**Haiti**	-0,37	-0,06	0,31
Nicaragua	2,56	2,02	-0,54	**Nicaragua**	3,38	2,71	-0,67
Paraguay	2,48	3,22	0,73	**Paraguay**	1,93	2,88	0,95
Venezuela	4,42	9,27	4,85	**Venezuela**	2,68	4,87	2,19
Developing Asia				Developing Asia			
China M	2,98	1,89	-1,09	**China M**	9,73	10,49	0,76
China	4,80	9,16	4,36	**China**	3,22	13,13	9,90

India	1,79	1,93	0,13	**India**	5,67	7,58	1,91
Malaysia	5,19	2,92	-2,27	**Malaysia**	6,82	4,35	-2,47
Pakistan	2,05	2,22	0,17	**Pakistan**	3,84	4,69	0,85
Vietnam	1,68	1,05	-0,63	**Vietnam**	7,31	7,32	0,00
Sub-Saharan Africa				Sub-Saharan Africa			
Kenya	1,78	2,08	0,30	**Kenya**	2,23	4,03	1,80
Madagascar	3,19	7,05	3,86	**Madagascar**	2,25	2,98	0,73
Malawi	8,39	3,97	-4,43	**Malawi**	2,04	4,59	2,56
Mauritius	1,82	1,75	-0,07	**Mauritius**	5,23	3,55	-1,68

Source: (IMF 2011); own calculations